AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

APRIL 15, 1958

ASTE TOOL SHOW NUMBER

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Continental's Fuel Injection System for Planes
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Powder Metallurgy Is Coming into Wider Use

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A CHILTON PUBLICATION

it's mainly a matter of TIMING!

WHEN to replace a machine can mean the difference between profit and loss

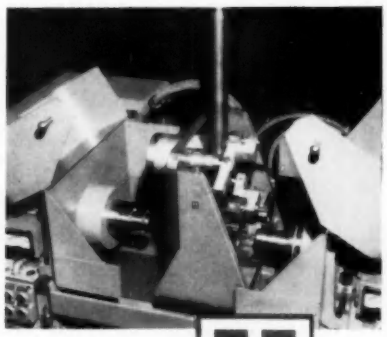
TOO EARLY is just as bad as too late. But somewhere in between there's a mathematically determinable *right time* to retire that old machine and replace it with a new one. A time when this replacement works out to your best advantage from the standpoint of production cost and capital investment.

Guess-work, intuition or rule-of-thumb computations usually come up with the wrong answer. And even carefully conceived "obsolesence formulas" may have their pitfalls. Because incorrect replacement timing, one way or the other, can *waste* thousands of dollars, this problem is of vital concern to all industry.

But Heald can help you solve it. Our sales engineers are well experienced in precise methods of replacement analysis. If you're in doubt, or would like to check your own computations, call in your Heald engineer. He will be glad to help you determine the right time to replace. And if now is too soon, he will tell you so. Similar cost studies by Heald engineers have pointed the way to many substantial savings.

For example: This new Heald Model 322 Bore-Matic replaced a heavy-duty drill for boring and chamfering hydraulic-cylinder piston rods. A cost analysis determined that the investment in a new machine could not be deferred any longer without serious financial loss. As verified by subsequent operation, the new machine offered the following savings:

	Old Machine	New Machine
Parts per hour	11	24
Machine load, per year	3,080 hrs.	1,380 hrs.
Direct & Indirect Labor	9,480 hrs.	3,240 hrs.
Annual Maintenance	$356	$100
Annual Operating Cost	$27,800	$15,000
Annual Saving, New Machine		$12,800
Net Return on Investment		39.6%



YOU pay for obsolesence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

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Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD ®

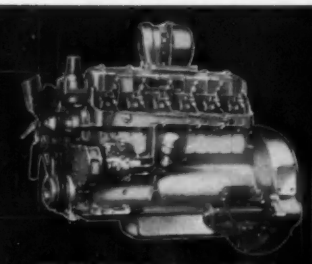
OVER THE ROAD... or OFF THE HIGHWAY

- fast
- smooth
- powerful

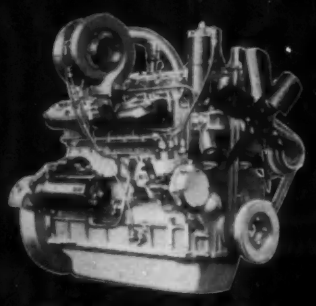
MODEL	Cyl.	*Features	Bore and Stroke	Displ. Cu. In.	Max. Torque @ RPM	Max. HP	RPM
TURBO-SUPERCHARGED DIESELS							
197-DLCS	6	ATV	4 x4	302	275-1800	131	2800
135-DKBS	6	ACTV	4¼x5	426	400-1800	185	2800
148-DKBS	6	ACTV	5¼x6	779	706-1800	280	2100
WAKDBS	6	ACTV	6¼x6½	1197	1062-1600	352	1800
NORMAL DIESELS							
180-DLC	4	AC	3½x3¾	144	102-1800	45	2400
185-DLC	6	A	3½x3¾	216	152-1000	60	2400
190-DLCA	6	AC	3¾x4	265	191-1400	84	2800
195-DLCA	6	AC	4 x4	302	221-1800	98	2800
197-DLC	6	AV	4 x4	302	216-1600	91	2800
135-DKB	6	ACV	4¼x5	426	328-1600	147	2800
148-DKB	6	ACV	5¼x6	779	584-1000	200	2100
WAKDB	6	ACV	6¼x6½	1197	845-1000	258	1800
GASOLINE							
180-GLB	4	AC	3½x3¾	144	118-1600	45	2400
185-GLB	6	A	3½x3¾	216	176-1400	67	2400
190-GLB	6	A	3¾x4	265	223-1200	77	2400
195-GKA	6	ACV	4⅛x4	320	244-1400	122	3000†
MZA	6	A	4¼x4¾	404	289-1000	128	2800†
135-GKB	6	ACV	4¼x5	426	337-1200	147	2800†
135-GZB	6	ACV	4⅜x5	451	354-1200	153	2800†
140-GKB	6	ACV	4½x5½	525	426-800	177	2600†
140-GZB	6	ACV	4⅝x5½	554	453-800	188	2600†
145-GKB	6	ACV	5¼x6	779	594-1000	240	2400†
145-GZB	6	ACV	5⅜x6	817	652-1200	260	2400†
WAKB	6	ACV	6¼x6½	1197	997-1000	280	1800

***FEATURES:** A—Aluminum Alloy Pistons; C—Counterbalanced Crankshaft; T—Turbo-Supercharged; V—Vibration Dampener.

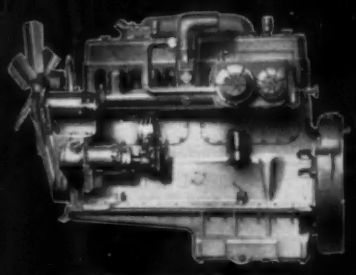
†These engines rated at higher hp and rpm for fire engine service. *Send for Bulletin 1079 for LPG ratings and complete listing of engine hp and speed ratings.*



197-DLCS—Turbocharged Diesel
(Also normally aspirated)



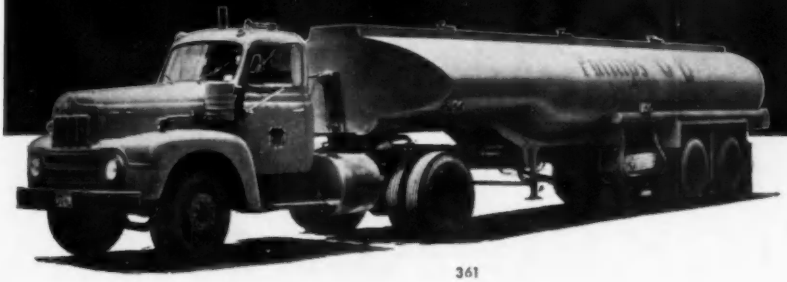
135-DKBS—Turbocharged Diesel
(Also normally aspirated)



WAKB—Equipped for butane

WAUKESHA ENGINES

NORMAL and TURBOCHARGED DIESELS
...GASOLINE...LP GAS
Standard or Counterbalanced Crankshafts



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Write for descriptive bulletins
WAUKESHA MOTOR COMPANY
Waukesha, Wisconsin
New York • Tulsa • Los Angeles

The Grumman Prototype F11F-1F "Tiger"

What keeps her fastenings fastened?

Automotive engineers may find the metal in the lock wire of the F11F-1F useful in solving their design problems

Where ambient temperatures are in the range of 400°F., designers of the F11F-1F "Tiger" decided they needed better than ordinary lock wire.

They found two Inco Nickel Alloys especially suited for this need.

Below 400°F., they use Monel* nickel-copper alloy wire. Monel alloy is stronger than mild steel and has good corrosion resistance.

Above 400°F., – in hot tail sections, for example, they use Inconel* nickel-chromium alloy wire. Inconel alloy has excellent high temperature strength and resistance to both oxidation and fatigue.

Ever consider using standard alloys to solve your design problem?

Monel and Inconel alloys are only two of a whole family of Inco Nickel Alloys that offer a wide variety of useful engineering properties. Perhaps one will solve your problem. Inco's Mechanical Engineering Section is ready now to help you find out. As a starter – outline your problem and send it to us.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO
TRADE MARK

INCO NICKEL ALLOYS

AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

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MEMBER — SBME Society of Business Magazine Editors

NBP National Business Publications, Inc.

ABC Audit Bureau of Circulations

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly) May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1893, May, 1918.

EDITORIAL EXECUTIVE OFFICES, Chestnut and 56th Sts., Philadelphia 39, Pa., U. S. A. Cable address—Autoland, Philadelphia.

AUTOMOTIVE INDUSTRIES. Published semi-monthly by Chilton Company, Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: To manufacturers in and suppliers to the automotive industries in the U. S., U. S. Possessions and Canada, $2.00 per year; $3.00 for 2 years. All Others, $10.00 per year. Single copies, 50¢. Statistical Issue, $1.00.

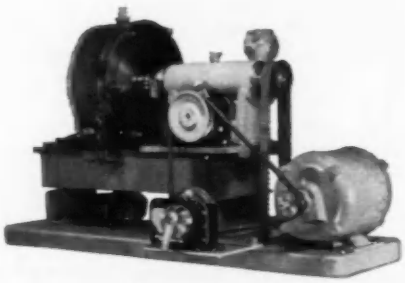
Automatic transmission seal problem—

New National Syntech® proves dependable answer in front pump seal position

Constant temperatures of 250°F, peaks of 300°, continual change in shaft speed, and total inaccessibility of the seal without costly teardown—these are a few of the sealing problems in the front pump of today's automatic transmissions for passenger cars.

To help meet this challenge, National engineers have produced a new oil seal. The new design, a steel encased, spring-loaded unit with Syntech synthetic sealing lip, is characterized by an unusually long flex section in the lip, a special, light-loading tension spring, and the time-tested, low torque Syntech lip itself.

Factory engineers report that the new National seals are proving extremely reliable in the application. Dealers also find the front pump seals are very reliable and do not require early replacement.



To design and thoroughly test the new seal, National engineers developed a new transmission simulator which exactly duplicates front pump operating conditions at all car speeds.

Get real help on seal engineering problems. Call the National Engineer.

NATIONAL SEAL Division, Federal-Mogul-Bower Bearings, Inc.

General Offices: Redwood City, California; Plants: Van Wert, Ohio, Downey and Redwood City, California

CLEAN IT FAST
WITH
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Pangborn now offers even greater blast cleaning savings with new high-capacity ROTOBLAST units throwing up to 160,000 pounds of abrasive per hour. To see how these ROTOBLAST units are incorporated in Pangborn's new machines for rotoblasting castings, forgings, hot rolled steel, super alloys, etc. write . . .
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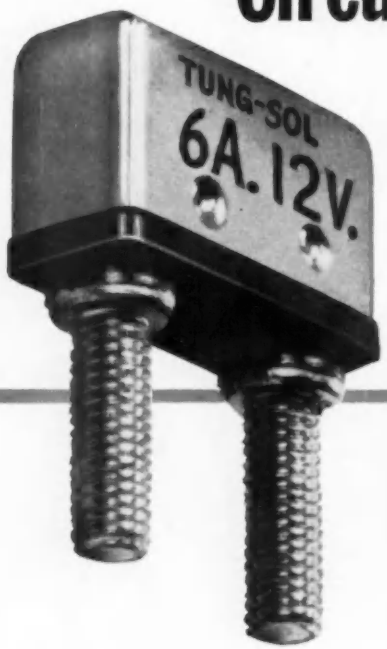
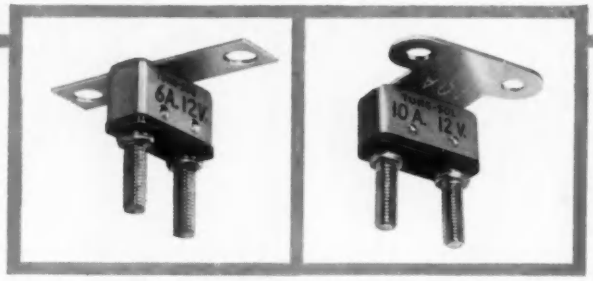
Manufacturers of Blast Cleaning and Dust Control Equipment
Pangborn at the Foundry Show, Cleveland, Ohio
Booth 2033-2037. Featuring heavy duty Pangborn
Barrels. Sizes up to 96 cubic feet capacity.

Tung-Sol 12-Volt Remote-Reset Circuit Breakers



Positive "Lock Open" Action gives complete protection against:

BURNED-OUT ACCESSORY MOTORS AND WIRING
PERMANENT BREAKER DAMAGE
RUN-DOWN BATTERIES



Standard Mounting Brackets

The Tung-Sol remote-reset type circuit breakers *lock open*, instead of continuing to pulsate, when the circuit is overloaded or shorted. When the cause of the overload or short is removed, the breaker is then remotely reset. It reactivates the circuit within 30 seconds.

Available in 6, 10, 15, 20, 30 and 40 amp. ratings, in a choice of two mounting brackets, Tung-Sol Remote-Reset Circuit Breakers are used in a wide variety of automotive applications. For further information write Engineering Department.

METHOD OF OPERATION

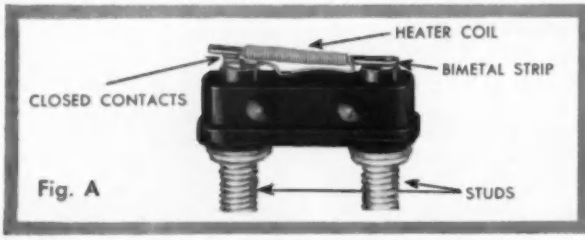


Fig. A

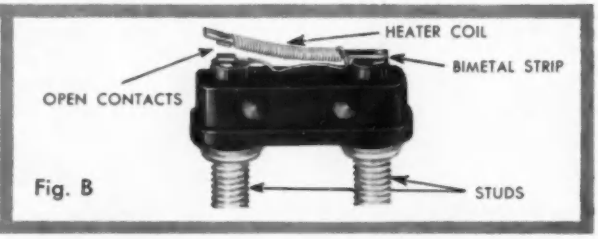


Fig. B

NORMAL CONDITIONS

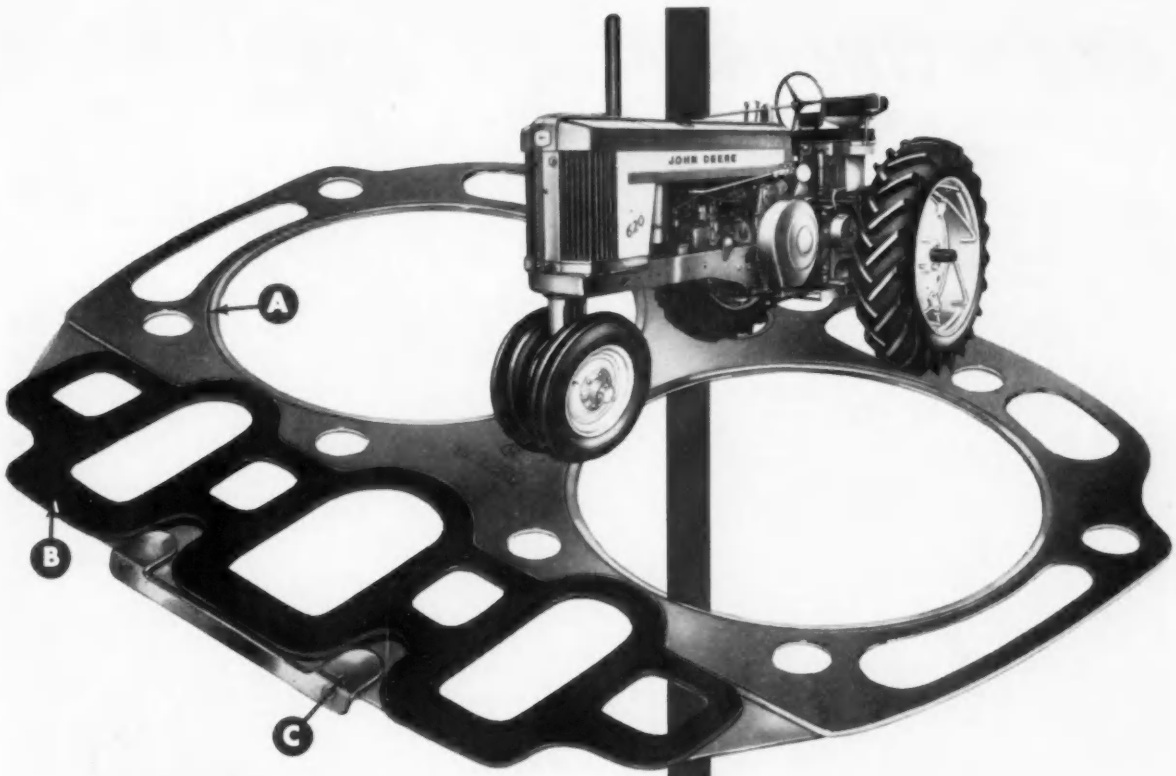
When circuit conditions are normal, the current flows thru the strip which is attached across breaker studs. When contacts are closed, the heater coil is short circuited and has no heating effect. (Fig. A).

EMERGENCY CONDITIONS

When a short circuit or overload occurs, the increased current causes strip to bend away from contacts. (Fig. B). When the contacts part, the coil is automatically inserted in the circuit.

ELECTROSWITCH DIVISION (ts) TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.

SALES OFFICES: ATLANTA, GA.; COLUMBUS, OHIO; CULVER CITY, CALIF.; DALLAS, TEXAS; DENVER, COLO.; DETROIT, MICH.; IRVINGTON, N. J.; MELROSE PARK, ILL.; NEWARK, N. J.; PHILADELPHIA, PA.; SEATTLE, WASH. CANADA: MONTREAL, P. Q.



How JOHN DEERE seals an intricate block casting

JOHN DEERE engineers assume no limitations on what can be done with gaskets. For example, take the case of sealing the Model 620 tractor engine.

Intricate block design created the problem of effectively sealing the coolant ports beyond the area of stud loading. The seal would have to compensate for heat expansion and shifts of the water holes in the block casting. Compressed thickness and resilience of the gasket overall would have to be balanced to insure maximum sealing of combustion chambers, exhaust, fuel and air ports.

Solution Comes from Standard Design

How JOHN DEERE engineers in cooperation with Victor specialists solved this problem is shown here. This partial modification of the standard VIC-2-FOLD design suggests the flexibility and wide scope of economical sealing service available from Victor.

Whatever you have to seal with gaskets or oil seals, Victor's unmatched facilities are yours to use. Contact your Victor Field Engineer or the factory.

Victor Mfg. & Gasket Co., P.O. Box 1333, Chicago 90, Ill.—Canadian Plant: St. Thomas, Ont.

A → **VIC-2-FOLD** modern metal-asbestos design insures tight sealing of combustion chambers, exhaust, fuel and air ports. Steel bottom layer, turned up and overlapping copper top layer at combustion openings, gives strong protection against breakdown and blowout. Copper top, turned down and overlapping steel layer, protects against corrosion.

B → **VICTOPRENE** insert, bonded to steel bottom layer, with overlap on openings, provides tight sealing of coolant chambers. Victoprene was selected for its lowest compression set values.

C → **Shim stop of brass,** riveted to bottom steel layer, prevents excessive compression on Victoprene insert.

Your files are not complete without Victor Gasket Engineering Catalog No. 505.

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GASKETS • PACKINGS • OIL SEALS • MECHANICAL SEALS

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FOR BRUTAL TREATMENT

SHOT-PEENED to make them up to 5 TIMES TOUGHER

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"THE WORLD TURNS ON U. S. AXLES"

THE US AXLE COMPANY, INC.

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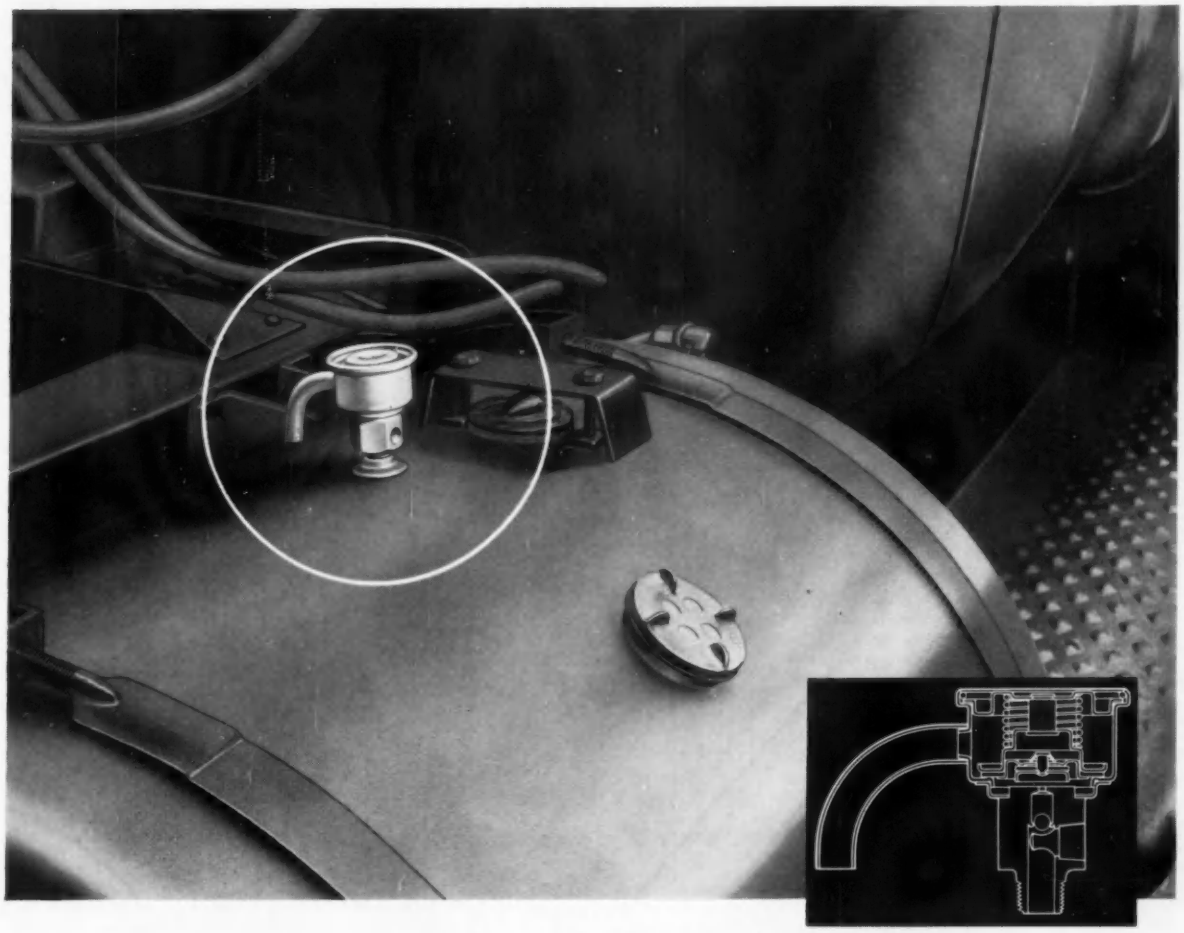
New... AC pressurized fuel systems



...prove they improve performance!

Tested in thousands of miles of operation, AC Pressurized Fuel Systems improved gasoline mileage by a full 10% and eliminated vapor locks under extreme heat and altitude conditions in day-to-day operation!

Here's why! Today's fuels are highly volatile and, even under normal conditions, tend to vaporize rapidly. This causes loss of fuel through the vent of the tank and creates vapor lock in the line between the tank and the pump. AC's Pressurized Fuel Systems eliminate both of these costly conditions!

Here's how! AC's "bivalve" accurately and automatically limits the pressure in the fuel tank to 3½ p.s.i. Both valves are spring loaded to assure perfect performance . . . the inlet valve eliminates vacuum caused by lowering the fuel level—the outlet valve releases pressure in excess of the controlled amount.

This pressure is the result of vaporization of the gasoline . . . 1 cu. in. of fuel can become 300 cu. in. of vapor above 80° F.

To learn how the performance of gasoline powered vehicles can be improved with the AC Pressurized Fuel System, consult any of these AC Offices—

Flint—1300 North Dort Highway Chicago—7074 N. Western Avenue Detroit—General Motors Building

AC SPARK PLUG ✿ THE ELECTRONICS DIVISION OF GENERAL MOTORS

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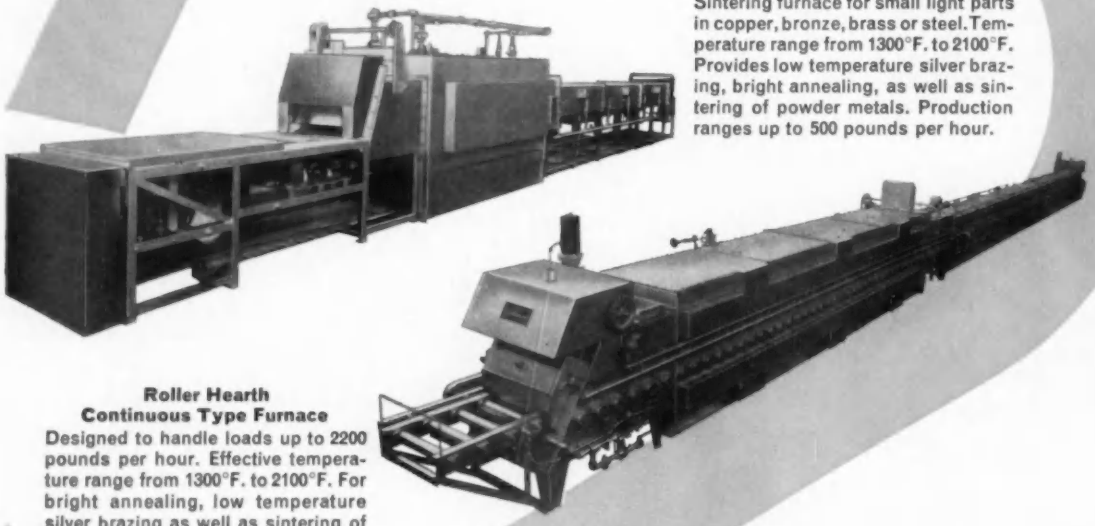
Look to Lindberg for sintering furnaces

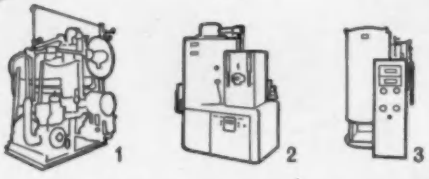
Hand Pusher Batch Type Furnace
For small production lots and experimental sintering. An all-purpose unit for operation from 1300° F. to 2500° F. Made in various sizes for sintering from 25 to 300 pounds per hour.

Mesh Belt Continuous Type Furnace
Sintering furnace for small light parts in copper, bronze, brass or steel. Temperature range from 1300°F. to 2100°F. Provides low temperature silver brazing, bright annealing, as well as sintering of powder metals. Production ranges up to 500 pounds per hour.



Roller Hearth Continuous Type Furnace
Designed to handle loads up to 2200 pounds per hour. Effective temperature range from 1300°F. to 2100°F. For bright annealing, low temperature silver brazing as well as sintering of powder metals.

For sintering furnaces, just as in all types of industrial heating equipment, you can depend on Lindberg's ability to supply exactly the right equipment for your needs. Just get in touch with your nearest Lindberg Field Representative, or write Lindberg Engineering Company, 2491 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.



Lindberg atmosphere generators provide the proper atmospheres recommended for use with Lindberg Sintering Furnaces. These are: 1. HYEX Generator... approximately 4% carbon dioxide—18% hydrogen—12% carbon monoxide and 66% nitrogen. 2. HYEN Generator... neutral atmosphere approximately 21% carbon monoxide—40% hydrogen—38% nitrogen and 1% methane. 3. HYAM Generator... composed of approximately 75% hydrogen and 25% nitrogen.

See Lindberg in Booth No. 12, Metal Powder Show in Philadelphia

LINDBERG heat for industry

two more UNIT PREAMPLIFIERS

in the new

SANBORN "450" SERIES

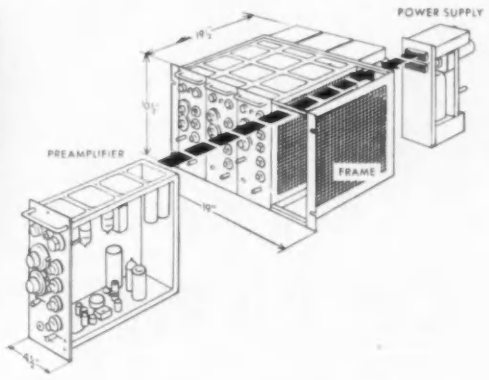
Here are the newest of the recently introduced Sanborn "450" Series Unit Preamplifiers—compact, lightweight, self-contained instruments for use with optical and tape recorders, wide band 'scopes, panel meters, computers, etc. (For use with high speed optical galvanometers at frequencies above 500 cps, requiring larger current swings, a transistor output amplifier is built into the 450-1800A True Differential DC type and available as optional equipment on other 450's.) As with all 450 Unit Preamplifiers, the new Servo Monitor and DC Coupling models mount in either individual portable cases or in the four-unit 19" module frame (#354-1100-C2) shown. The *450* designation refers to *unit packaging* of Sanborn 350 Preamplifiers and Power Supplies in individual 450 cases. Loosening two front panel thumbscrews allows quick, simple interchangeability. Since *all* "450" Preamps use the 350-500 Power Supply (which remains in place at the rear of the frame or case), new requirements necessitate only additional *Preamplifier* units, permitting sizable savings in equipment investment.

The Model 450-1200 is a phase-sensitive demodulator, whose DC output voltage is proportional to the in-phase (or 180° out-of-phase) component of an AC signal with respect to a reference. Precision measurement is realized by such characteristics as negligible quadrature signal error, provision for floating signal and reference inputs, front panel VTVM for accurate calibration signals. The 450-1200 accepts the outputs of resolvers, synchros, differential transformers and other transducers. The 450-1300A is a moderate gain, balanced input—balanced output DC amplifier. Its input circuit performs equally well with single-ended or balanced signals.

The "450" Series Unit Preamplifiers presently include the Model 450-1100 Carrier, 450-1200 Servo Monitor, 450-1300A DC Coupling and 450-1800A True Differential DC types. Following these will be "450" Series Logarithmic and Low Level types. Further data and application information on present models is available on request.

Model 450-1200 Servo Monitor (Demodulator) Preamplifier

Model 450-1300A DC Coupling Preamplifier



MAJOR SPECIFICATIONS

MODEL 450-1200 SERVO MONITOR PREAMPLIFIER

Sensitivity: 5 mv (in phase) produces 1 volt at output jack under maximum output load conditions
Input Impedance: Signal 100k
Reference 12.5k for 15 volts, 55k for 120 volts
Frequency Response: 3db down at 20% of carrier frequency filter position
Carrier Frequency Filter: Selected by a switch (three positions)
Low 60 cycles
Med 400 cycles
Hi 1000 cycles (5000 cycles optional)
Reference Voltage: Internal selection accepts voltages from 15 to 120 volts
Quadrature Rejection: Ratio better than 100:1
Maximum permissible quadrature before overload indicator lights is twice full scale (in phase)
Calibrate Voltage: 10 millivolts internal (set by meter on panel)
Drift: Less than 0.1% of full scale per hour
Preamplifier Output Jack: ±3 volts available into 2.2k minimum load resistance. Output appears across two cathodes at approximately ground potential
Rear inputs and **overload indicator lights** are included
Output Impedance: 1k
Overall Linearity: ±¼%
Power Requirements: 115 volts, 50-400 cycles, approximately 35 watts

MODEL 450-1300A DC COUPLING PREAMPLIFIER

Sensitivity: 50 mv produces 1 volt at output jack under maximum output load conditions
Input Impedance: 5 megohms each input side to ground
Input: Single-ended or push-pull
Preamplifier Output Jack: ±3 volts into 2.2k minimum load resistance. Output is balanced and appears across 2 cathodes at approx. ground potential
Output Impedance: 1k
Drift: Referred to input 2 mv/hr. line voltages change less than 10%
Frequency Response: 0-20kc
Calibration: 100 millivolts internal
Linearity: ±¼%
Rear inputs included

SANBORN COMPANY
INDUSTRIAL DIVISION
175 WYMAN STREET, WALTHAM 54, MASS.

Let Bundyweld help you profit from the automotive air conditioning boom!

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Copper coating fuses with steel. Result . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

←

NOTE the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead and less chance for any leakage.

For 20 years—the leading tubing in the automotive and refrigeration industries, Bundyweld is ideally suited for new application which includes both fields

Automotive air-conditioning sales climb daily. Experts see the sale of 500,000 air-conditioned cars a year just around the corner. The boom is under way.

Naturally, you're drawing a bead on this new business. And one good way of getting your share is to offer a reliable, trouble-free air-conditioning system. One way to be sure that system will be reliable is to specify Bundyweld Tubing—as famed in the refrigeration industry as it is in the automotive industry.

For instance, did you know that Bundyweld's ability to tame escape-minded refrigerants has made it the standard of the refrigeration industry for over twenty years? Did you know that the refrigeration industry uses about 1,000,000 feet of Bundyweld daily for its compressors, condensers, evaporators, connector lines, and other refrigeration tubing parts?

Of course, we back up the world's most dependable small-diameter tubing with unexcelled fabrication facilities and a staff of expert engineering specialists—plus custom packaging of your orders; prompt, on-schedule deliveries and the bulldog-like tenacity of working with you until any tubing problem is cracked. Call, write, or wire for information or for help with your air-conditioning problem.

BUNDY TUBING COMPANY
DETROIT 14, MICHIGAN

BUNDYWELD TUBING®

DOUBLE-WALLED FROM A SINGLE STRIP

Bundy Tubing Distributors and Representatives: ***Northeast:*** Chas. H. Stamm, 10 N. Main St., West Hartford, Conn.; Austin-Hastings Co., Inc., 226 Binney Street, Cambridge 42, Mass. • ***Middle Atlantic:*** Atlantic Tube & Metals, Inc., 451 New Jersey State Highway #23, Wayne, N. J.; Rutan & Co., 1 Bala Ave., Bala-Cynwyd, Pa. • ***Midwest:*** Lapham-Hickey Steel Corp., 3333 W. 47th Place, Chicago 32, Ill.; Williams and Company, Inc., 901 Pennsylvania Ave., Pittsburgh 33, Pa. • ***South:*** Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg., Chattanooga 2, Tenn. • ***Southwest:*** Vinson Steel & Aluminum Co., 4606 Singleton Blvd., Dallas, Texas • ***Northwest:*** Eagle Metals Co., 4755 First Avenue, South Seattle 4, Wash. • ***Far West:*** Pacific Metals Co., Ltd., 2187 S. Garfield, Los Angeles 22, Calif.; Pacific Metals Co., Ltd., 1900 Third Street, San Francisco 7, Calif.

Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.

THE MODERN TOOL . . . AT WORK FOR MODERN INDUSTRY

You get all 5 with Polyken® masking tape

1. Easy unwind
Saves time . . . comes off roll without hard pull. Tears crosswise readily.

2. Quick adhesion
Sticks tight with only a slight touch . . . won't slip or curl back. Resists moisture, too.

3. Conformability
Flexible even on extreme curves. Crepe backing gives extra stretch needed at sharp angles without being rough on the hands.

4. Extreme thinness
No paint build-up during spraying operations.

5. Clean pull-off
Unaffected by forced heat drying. Leaves sharp edge without any sticky residue.

THIS ONE TAPE GIVES YOU FINEST CREPE MASKING QUALITY . . . PLUS ECONOMY FOR ANY JOB.

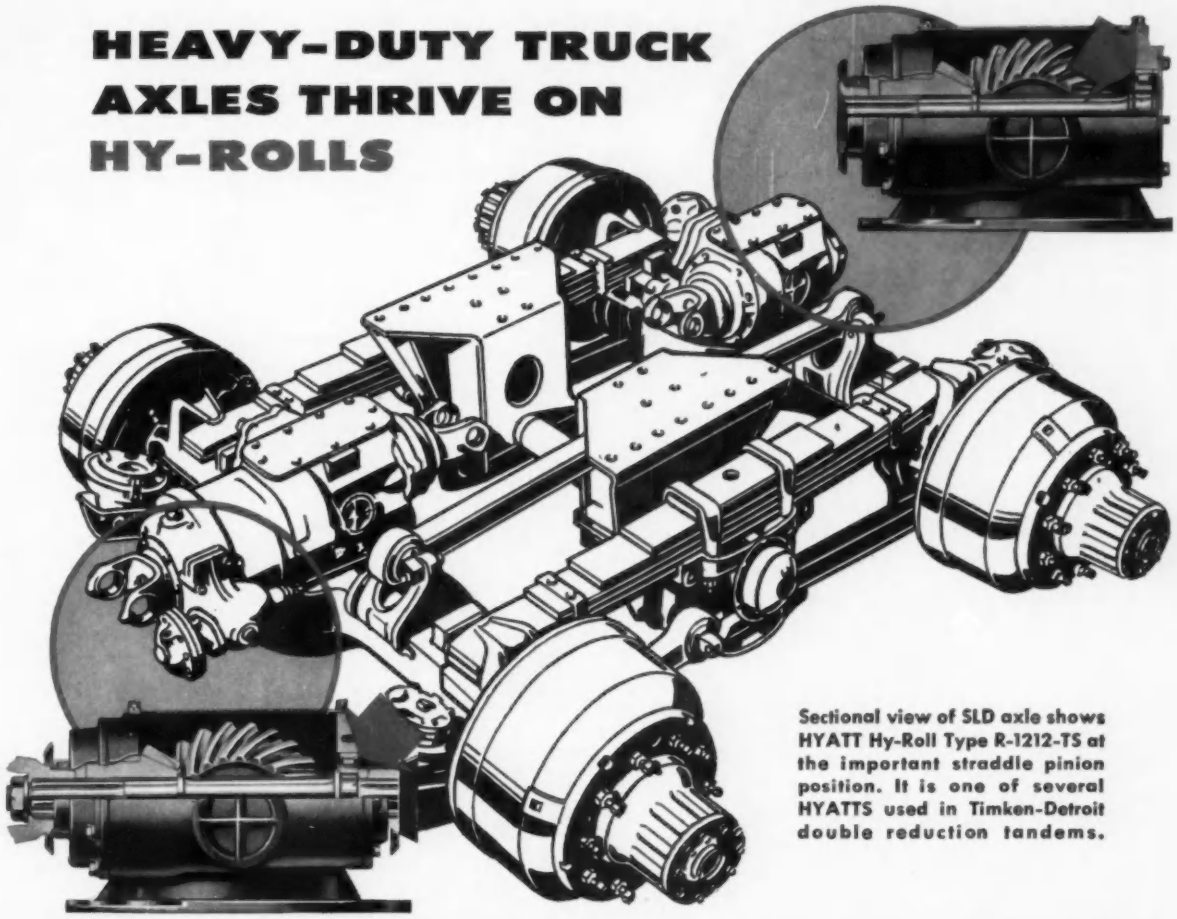
For help with your taping job—look up the Polyken Industrial Tape Distributor nearest you, or write to the Polyken Sales Division, 309 W. Jackson Blvd., Chicago 6.

Polyken®

INDUSTRIAL TAPES

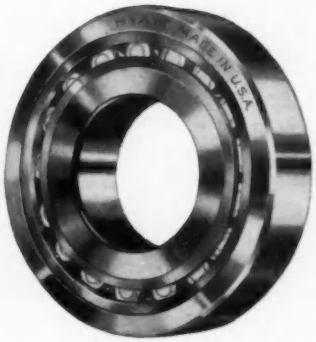
THE KENDALL COMPANY
Polyken Sales Division

HEAVY-DUTY TRUCK AXLES THRIVE ON HY-ROLLS



Sectional view of SLD axle shows HYATT Hy-Roll Type R-1212-TS at the important straddle pinion position. It is one of several HYATTS used in Timken-Detroit double reduction tandems.

TIMKEN-DETROIT SPECIFIES HYATT HY-ROLL BEARINGS FOR SLD, SLDD TANDEM AXLES



These rugged Timken-Detroit top mounted tandems, with straight line drive through double reduction gears, are earning a reputation for dependability and parts interchangeability which keeps downtime and maintenance costs very low.

Typical of the top-quality components that go into these axles are HYATT cylindrical roller bearings, chosen for their ability to carry extremely heavy radial loads without restricting lateral movement, and their ease of assembly and disassembly. Timken-Detroit Division of Rockwell Spring and Axle Company, like other leaders in the industry, depends on HYATT engineering and production know-how for the *best* in bearings. So can you! Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey; Detroit; Chicago; Pittsburgh; Oakland, California.

THESE LEADING COMPONENT MANUFACTURERS ALL USE HYATT BEARINGS:

★ CLARK EQUIPMENT COMPANY (transmissions and axles)

★ DANA CORPORATION (Spicer transmissions)

★ EATON MANUFACTURING COMPANY (axles)

★ FULLER MANUFACTURING COMPANY (transmissions)

★ ROCKWELL SPRING AND AXLE COMPANY (Timken-Detroit axles)

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

1908–1958 GM FORWARD FROM FIFTY

HYATT HY-ROLL BEARINGS FOR CARS AND TRUCKS

MORE BOTTLES IN SAME WAREHOUSE! Filled wine bottles get a smooth, high lift on Yale K51W Trucks. Full use of air rights boosts warehouse capacity for Gallo—8,000 more bottles!

boosts production, slashes handling costs with YALE K51W ELECTRIC TRUCKS

speeds empties in-speeds cases out!

Gallo's winery at Modesto, Calif. is one of the nation's largest. Here, 32 different types of wines are produced, bottled and shipped. With production steadily increasing, Gallo management faced a common problem: outmoded, obsolete equipment—unable to handle soaring output. For a solution, Gallo called in Yale engineers. Together, they came up with a new handling system that has produced amazing results.

Today, a fleet of new, heavy-duty Yale K51W Electric Trucks unloads thousands of empty bottles a day—feeds them to 6 non-stop bottling lines. Every day these same trucks stack hundreds of full cases in warehouses and load them onto trucks and rail for shipment. Result: fast-cycle operations – big savings in storage space – handling costs at an all time low! Here's why:

Yale K51W is fast! Travels up to 6½ m.p.h. Lifts full 50 ft. a minute.

Yale K51W is short! Only 68¼" from front face of forks. Compactness makes fast maneuvering easy, lets you trim warehouse aisles for extra storage space.

Yale K51W is safe! Excellent operator visibility. Maximum stability. Dead-man control.

Yale K51W is easy to drive! Full forward visibility. Special inching control. Exclusive Yale magnetic Cam-O-Tactor for controlled acceleration. High-capacity battery for 8-hour operation without recharging.

Learn how *you* can cut handling costs with the 3,000-4,000 lb. capacity Yale K51W Electric Truck or, send for information on any of the broad line of Yale Industrial Lift Trucks – Gasoline, Electric, LP-Gas, *Worksavers*, Warehousers, Hand Trucks. Wide range of capacities. Write The Yale & Towne Mfg. Co., Philadelphia 15, Pa., Dept. A-74.

THIS IS MANEUVERABILITY! Short Yale K51W works at top speed in aisles less than 10 feet wide. 15° tilt-back improves maneuverability and speeds up operation.

FAST SHUTTLE! Yale K51W unloads this trailer truck in only 12 trips. Takes empties directly to bottling lines to meet tight production schedules.

YALE* *REG. U.S. PAT. OFF.

INDUSTRIAL LIFT TRUCKS AND HOISTS

YALE & TOWNE

GASOLINE, ELECTRIC, DIESEL & LP-GAS INDUSTRIAL LIFT TRUCKS • WORKSAVERS
WAREHOUSERS • HAND TRUCKS • HAND AND ELECTRIC HOISTS

YALE MATERIALS HANDLING DIVISION, THE YALE & TOWNE MANUFACTURING CO. MANUFACTURING PLANTS: PHILADELPHIA, PA.; SAN LEANDRO, CALIF.; FORREST CITY, ARK.

Here's the kind of service you get . . .

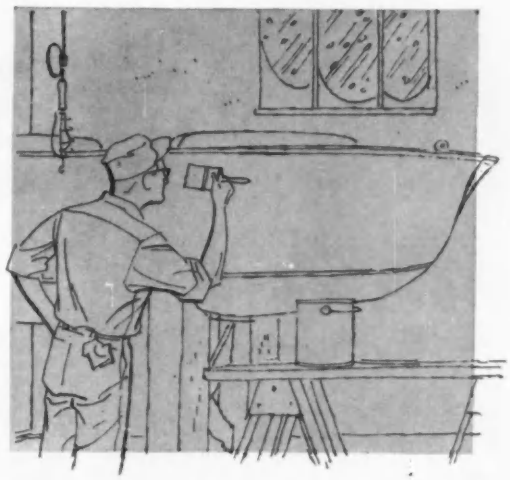
with HONEYWELL instrumentation

Bill Lewis, typical service engineer, proves how you can depend on Honeywell for fast, on-the-spot service even in emergencies.

3 It took Bill two hours to drive to the plant through the storm. He spotted the trouble immediately; a thermocouple and its protecting tube had burned out. It might have meant four to five thousand dollars' worth of damage.

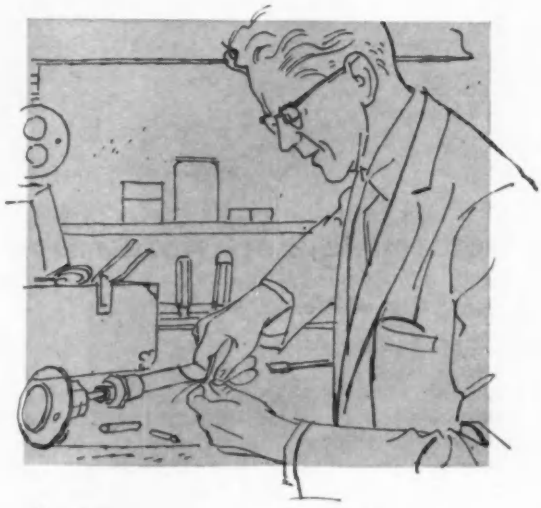
Honeywell service begins when you first decide you need instruments, and continues long after they're installed. It includes:

- Preliminary engineering, even before specifications are written.
- Application engineering for installation and startup.
- Service engineering help from your nearby Honeywell branch.
- Periodic service and swift help in emergencies.
- Training of your operators at the Honeywell Instrumentation Education Center.



1 Bill Lewis, service engineer at Honeywell's Fort Wayne branch, was in his garage, touching up the paint on his 13-foot outboard. The bowling match had been called off that night because of the snowstorm, and Bill was glad to be home.

2 At 9:30 a call came from the Crosby Laughlin Division of American Hoist and Derrick Company in Fort Wayne. A controller on a galvanizing kettle wasn't working and unless it was fixed fast, the pot would either freeze or burn out. Bill said he would be out right away.



4 Bill didn't have a thermocouple with him that would fit, so he improvised a temporary couple and protecting tube and got the system going. Early the next morning he called the Honeywell branch in Indianapolis and had the correct thermocouple and tube shipped quickly to the plant. Next day, he carefully checked out the entire installation.

5 Now, Crosby Laughlin Division is signed up with the Honeywell Periodic Service Plan, and its complete instrumentation is checked and serviced every month. Any spare parts needed are now available at Honeywell's Fort Wayne branch. Bill hasn't had to make another emergency call to the plant since.

Around-the-clock help in emergencies is but one of many Honeywell services that give you extra value for your investment in instruments. Get the complete service story from your nearby Honeywell field engineer. He's as near as your phone.

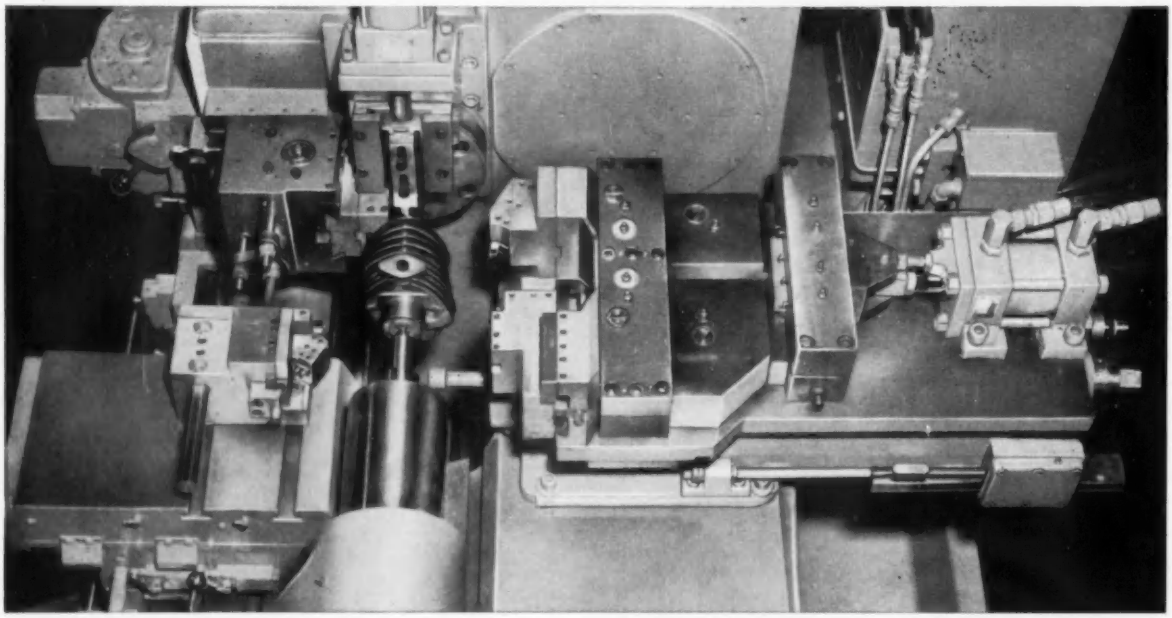
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Products Group* . . . Brown Instruments, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL

First in Controls

Six different sizes and types of workpieces are handled easily on this job. Extra expanding mandrel and sleeves at right are for different sizes.



How Harley-Davidson speeds motorcycle part production

Machines both ends in single chucking, using Gisholt No. 12 Automatic to get maximum accuracy, cut production costs

This well-planned setup reveals how Harley-Davidson Motor Co., Milwaukee, Wis., is handling cast iron front and rear cylinders.

Smart tooling on a Gisholt MASTERLINE No. 12 Automatic Production Lathe handles 6 different sizes and types of workpieces. Change-over is fast and easy. A special headstock-mounted, air-operated locating stop speeds work handling.

While tools in the front carriage turn and chamfer at one end of the piece, tools in a headstock-mounted auxiliary slide chamfer the I.D. on the other side. Simultaneously, tools on the rear slide face both ends for length. At the end of the cut, tool blocks on the rear independent slide swing open automatically to provide tool relief before withdrawal. Floor-to-floor time on the part shown is 1.2 minutes, only 1.8 to 3.6 minutes for the other 5 workpiece types and sizes.

The new Gisholt MASTERLINE No. 12 Automatic Production Lathe is designed specifically for high production operations; yet, it is flexible enough to handle a variety of similar parts in small repeat lots. The automatic cycle frees the operator to handle other machines or do other work.

Make a note to phone your Gisholt Representative today. Ask him to come in and show you where the fast automatic cycle and flexibility of the No. 12 Automatic Production Lathe can cut your floor-to-floor time and reduce your costs.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTIC

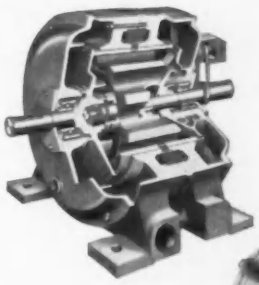
ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY REBUILT MACHINES WITH NEW MACHINE GUARANTEE

When You See this Nameplate— You Know Someone Has Solved a Problem!

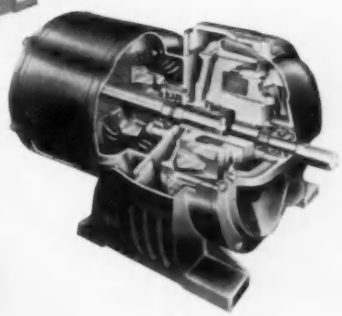
Your problem may be in the field of speed control, tension control, power transmission, or testing. Dynamatic Eddy-Current Equipment—couplings, brakes, drives, dynamometers — is solving these problems in virtually every industry, in both plant equipment and end products. It can do the same for you.

Dynamatic units offer the important advantages of rapid response, wide speed range, quiet operation, low power loss, low maintenance costs, and stepless adjustable speeds from an AC power source.

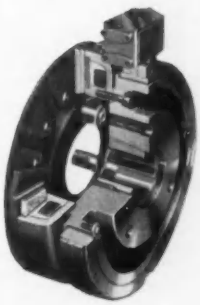
And Eaton Dyna-torQ magnetic-friction industrial clutches and brakes are solving driving and braking problems in all industries where accurate start-and-stop control is required. Check with the Eaton Dynamatic representative or distributor in your locality, or—



DYNAMATIC EDDY-CURRENT COUPLINGS AND BRAKES



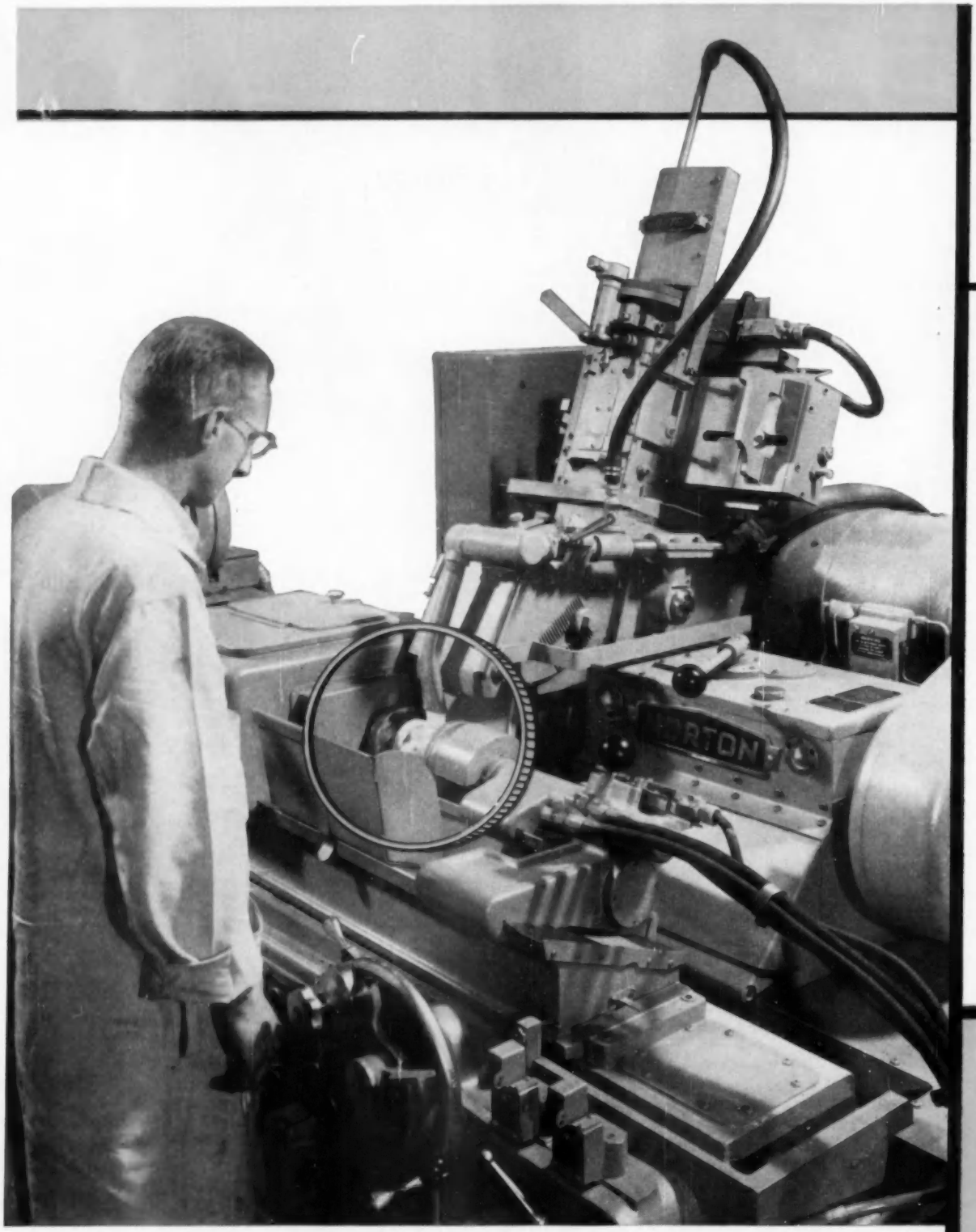
DYNAMATIC AJUSTO-SPEDE® AND DYNA-SPEDE® DRIVES



DYNA-TORQ MAGNETIC-FRICTION CLUTCHES, BRAKES, CLUTCH-BRAKES, CLUTCH-COUPLINGS

Send for Illustrated Descriptive Literature
Covering Dynamatic Eddy-Current and Dyna-torQ Equipment

EATON — DYNAMATIC DIVISION — MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN



DESIGNED FOR HEAVY DUTY, HIGH PRODUCTION SERVICE, the Norton 6" x 8" Semiautomatic Piston Grinder produces standard automotive and other types of pistons. Its high speed, accuracy and economical operation add the "Touch of Gold" that produces more pistons and lowers your costs.

Here's why you can grind pistons better for less money

with the Norton 6" x 8" semiautomatic piston grinding machine

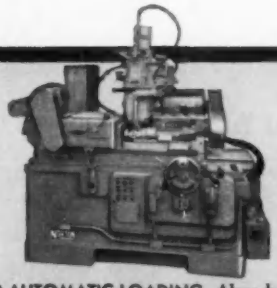
Fast automatic sizing is just one important advantage of the Norton 6" x 8" Piston Grinder. This is assured by the repetitive accuracy of the easily adjustable "micrometric-type" revolving screw wheel feed mechanism — *plus* the heavy wheel spindle unit that resists wheel pressures — *plus* the rugged cam generating mechanism that provides enduring accuracy of the motion required for piston skirt form. And this rapid action is built-in for the life of the machine, thanks to massive proportions and generous wear surfaces.

Other High Production Advantages

- *Simplified Operation* that reduces operator fatigue through convenient location of controls. The operator can make all adjustments for feeds and speeds without leaving his normal position.
- *Automatic Functioning* that operates at a pre-determined pace, hour after hour, minimizing effort and increasing production through elimination of lag due to operator fatigue.
- *Automatic Grinding Cycle,* operating under electrically timed control and adjustable over a wide range. Starting at the touch of a single lever, the grinding cycle terminates at the pre-set time, ready for removal of the work. (Rotation of the work may be stopped automatically, in the most convenient unloading position, by an optional "electric-eye" arrangement.)
- *Automatic Wheel Truing.* Merely touching a push-button sends the wheel head mounted automatic truing device on a round trip across the wheel face at pre-determined speed and feed. This not only lessens the time and skill usually required for truing, but gives closer control of the amount of abrasive removed, thus reducing the wheel cost per piece ground.

Get the Whole Story

on how the Norton 6" x 8" Semiautomatic Piston Grinding Machine can benefit your production. See your Norton Representative, or write direct for Catalog No. 742. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Massachusetts.



IDEAL FOR AUTOMATIC LOADING. Already greatly simplified in operation, and with many automatic features, this advanced grinder is readily adaptable for automatic loading and unloading. Also, it is available under the Norton Lease and Purchase Financing Plans, which enable you to modernize while conserving your capital. Full particulars on request.

To Economize, Modernize with **NEW**

NORTON

GRINDERS and LAPPERS

Making better products...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

District Offices: Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.

Another Tinnerman Original...

Self-retaining "U" and "J" SPEED NUTS® cut assembly costs up to 50% or more!

If you are worried about rising assembly costs, let one-piece "U" and "J" SPEED NUTS keep costs down... and improve your product.

They can't fall off, once they've been pressed into screw-receiving position. No welding, staking or other secondary fastening devices needed. You eliminate lock washers—spring steel SPEED NUTS are self-locking, make vibration-proof attachments.

SPEED NUTS are ideal for blind assembly or hard-to-reach locations. Apply them *before* you paint panels without danger of paint-clogging. Or *after* porcelainizing, without damage to finishes. The "U" type is similar to the "J" type, shown above, but is used where full bearing surface on the lower leg is required.

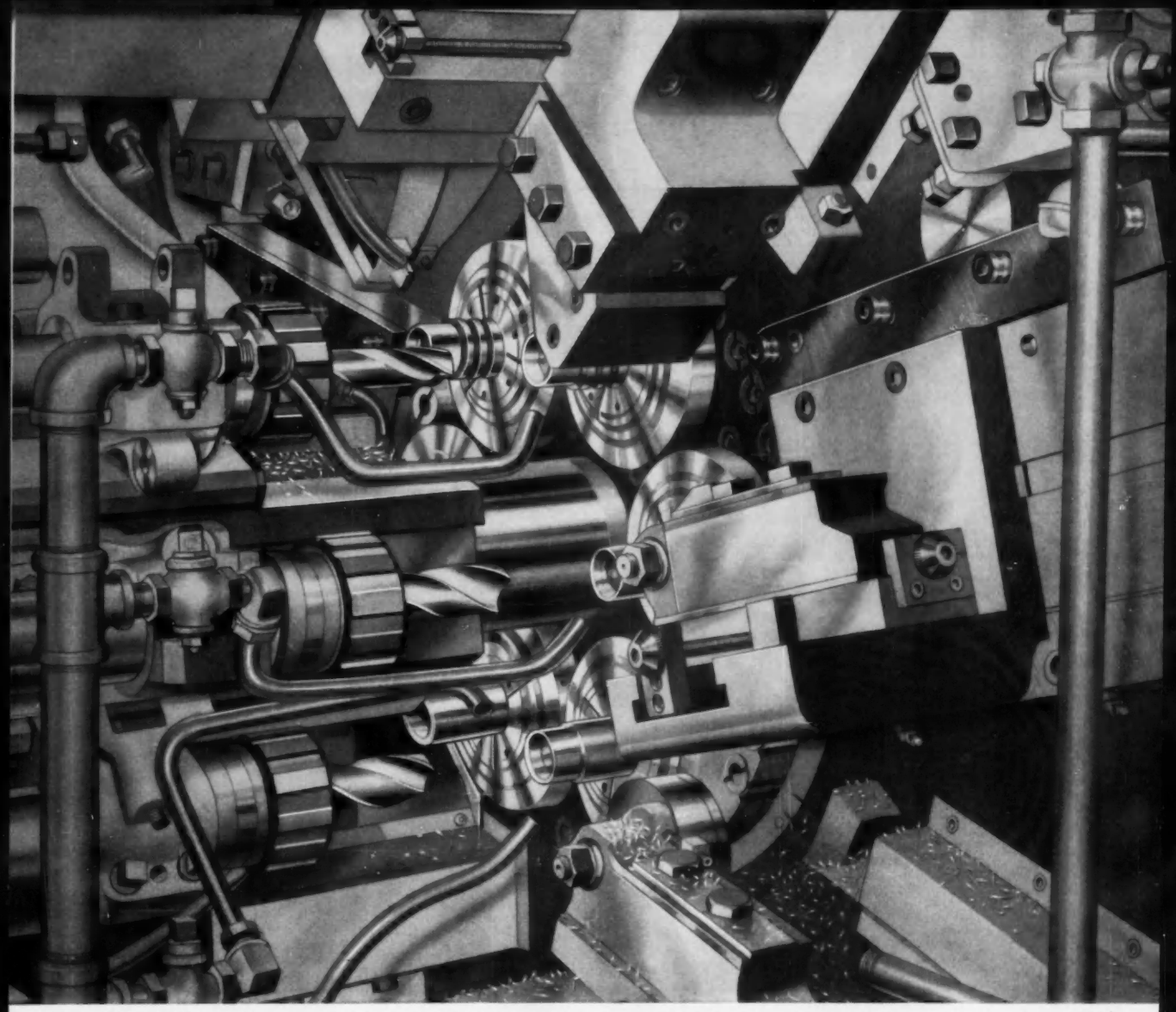
A free Fastening Analysis can tell where SPEED NUT brand fasteners belong on your products. Call your Tinnerman representative—he's listed in most major telephone directories. Or write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

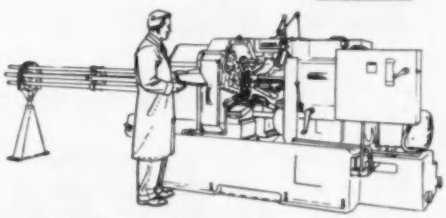
FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.



for lower costs — put more tools to work

You can make money with the speed, versatility, accuracy and extra operations possible on the *new* New Britain Automatic Bar Machines with independent radial cross slides in all six positions. More operations per machine, at higher speeds and feeds, mean more completed pieces in the pan, faster than ever before. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



NEW BRITAIN AUTOMATIC BAR MACHINE

GREENLEE TRANSFER MACHINES

Change with Your Requirements

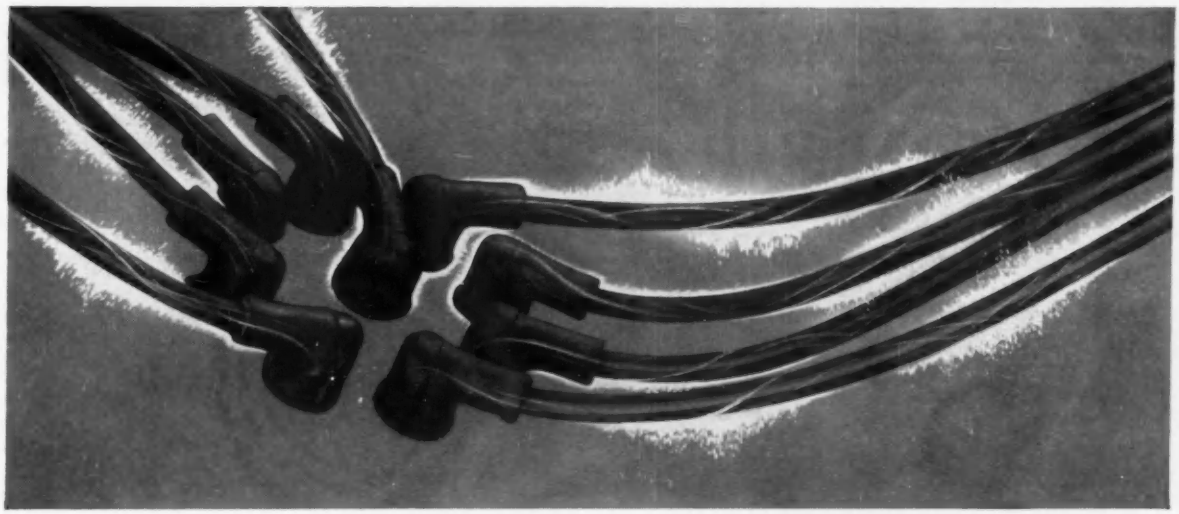
THIS MACHINE HAS BEEN REWORKED FOUR TIMES

The "building block" idea of machine tool design has gained much popularity in recent years. Greenlee has long built such flexibility into their transfer machines. For example, the machine shown here has been modified 4 times in 11 years to accommodate changes in product design. Protect yourself from costly obsolescence. Ask Greenlee to show you how.

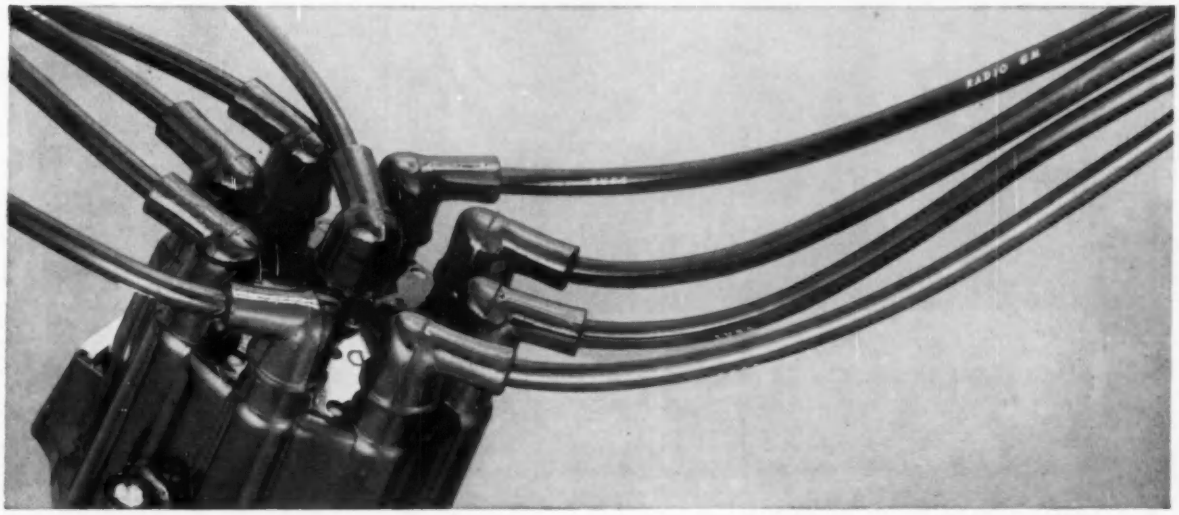
PHONE ROCKFORD, ILLINOIS 3-4881
TO HELP SOLVE YOUR PRODUCTION PROBLEMS

GREENLEE
BROS. & CO.

1754 MASON AVE.
ROCKFORD, ILLINOIS



DON'T / *"broadcast" trouble through ordinary ignition cable!*



DO / *suppress Radio-TV interference with Packard T.V.R.S. cable!*

Packard Electric's exclusive T.V.R.S. cable carries the electricity that makes the ignition spark, while it simultaneously stops interference.

Thus, using *only* Packard T.V.R.S. cable, you successfully stop "broadcasting" ignition interference, which can drastically affect operation of car radios and neighboring TV sets. By distributing resistance over the entire wiring circuit, T.V.R.S. cable does a more effective suppression job than can be done any other way.

T.V.R.S. cable makes spark plugs last longer, too. The non-metallic conductor reduces electrical oscillations which cause spark plug electrode erosion.

A Packard Electric terminal-attaching process makes T.V.R.S. cable easy to use on any ignition system. And packaged replacement kits are available for all your service needs. Get the facts now. T.V.R.S. cables can eliminate a troublesome problem for you—and save you money besides! Packard Electric maintains offices in Detroit, Chicago and Oakland, California for your convenience.

Packard *Electric*

Warren, Ohio

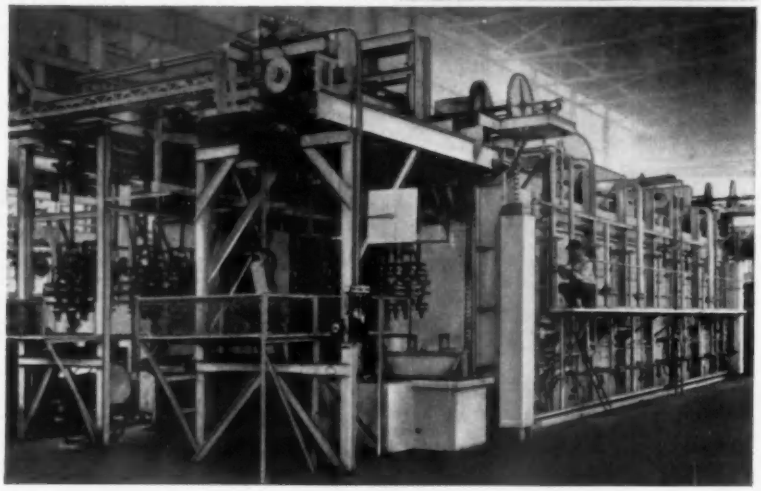
"Live Wire" division of General Motors

HOLCROFT...FINEST IN HEAT TREAT FURNACES FOR OVER 40 YEARS

EXPERIENCE PAYS OFF IN HEAT TREAT FURNACES

1928

1958



HOLCROFT HAS IT!

Take, for example, the crankshaft heat treating furnaces illustrated above. Years of experience preceded the design and development of the old *1928* unit . . . and in its day it was one of the best, turning out a phenomenal 150 cranks an hour with just four operators.

Today, Holcroft is still building the best . . . as typified by the modern crankshaft unit above. Here, Holcroft has conveyor-integrated three separate units . . . each consisting of a hardening furnace, quench tank, draw furnace and cooling station . . . into a completely automated installation capable of heat treating 456 crankshafts an hour. And only two men are required to perform the *one* manual operation . . . transferring cranks from one conveyor to another at the central loading station. So you see, in production heat treat furnaces, Holcroft experience *does* pay-off, in better heat treating, more efficient operation, lower production costs than ordinary, perhaps less expensive furnaces,can give you.

HOLCROFT AND COMPANY

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PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • HARTFORD, CONN. • HOUSTON, TEXAS • PHILA., PA.

CANADA: Walker Metal Products, Ltd., Windsor, Ontario

CALENDAR

OF COMING SHOWS AND MEETINGS

National Industrial Health Conference, Convention Hall, Atlantic City, N. J. .....Apr. 19-25

Metal Powder Association, annual meeting, Sheraton Hotel, Philadelphia, Pa. .....Apr. 21-23

American Society of Lubrication Engineers, annual meeting, Hotel Cleveland, Cleveland, O. Apr. 22-24

U. S. Chamber of Commerce, annual meeting, Washington, D. C. Apr. 27-30

AIEE Middle Eastern District Meeting, Sheraton-Park Hotel, Washington, D. C. .....Apr. 28-30

Air Force Office of Scientific Research Astronautics Symposium, sponsored by Institute of Aeronautical Sciences, Shirley-Savoy Hotel, Denver, Colo. Apr. 28-30

Westinghouse 1958 Machine Tool Forum, Hotel Statler, Buffalo, N. Y. .....Apr. 29-30

National Screw Machine Products Association, annual meeting, Drake Hotel, Chicago, Ill. Apr. 30-May 3

American Society of Tool Engineers, annual meeting and tool show, Convention Hall, Philadelphia, Pa. .....May 1-8

AIEE Great Lakes District Meeting, Kellog Center, Michigan State University, East Lansing Mich. .....May 5-7

Western Regional Material Handling Show, Great Western Exhibit Center, Los Angeles, Calif. .....May 8-10

American Society for Metals, Southwest Metal Exposition and Congress, Dallas, Tex.....May 12-16

Society for Experimental Stress Analysis, spring meeting, Hotel Manger, Cleveland, O.....May 14-16

National Truck, Trailer and Equipment Show, Great Western Exhibit Building, Los Angeles, Calif. .....May 15-18

Society of Aeronautical Weight Engineers, Inc., Belmont Plaza, New York, N. Y. .....May 19-22

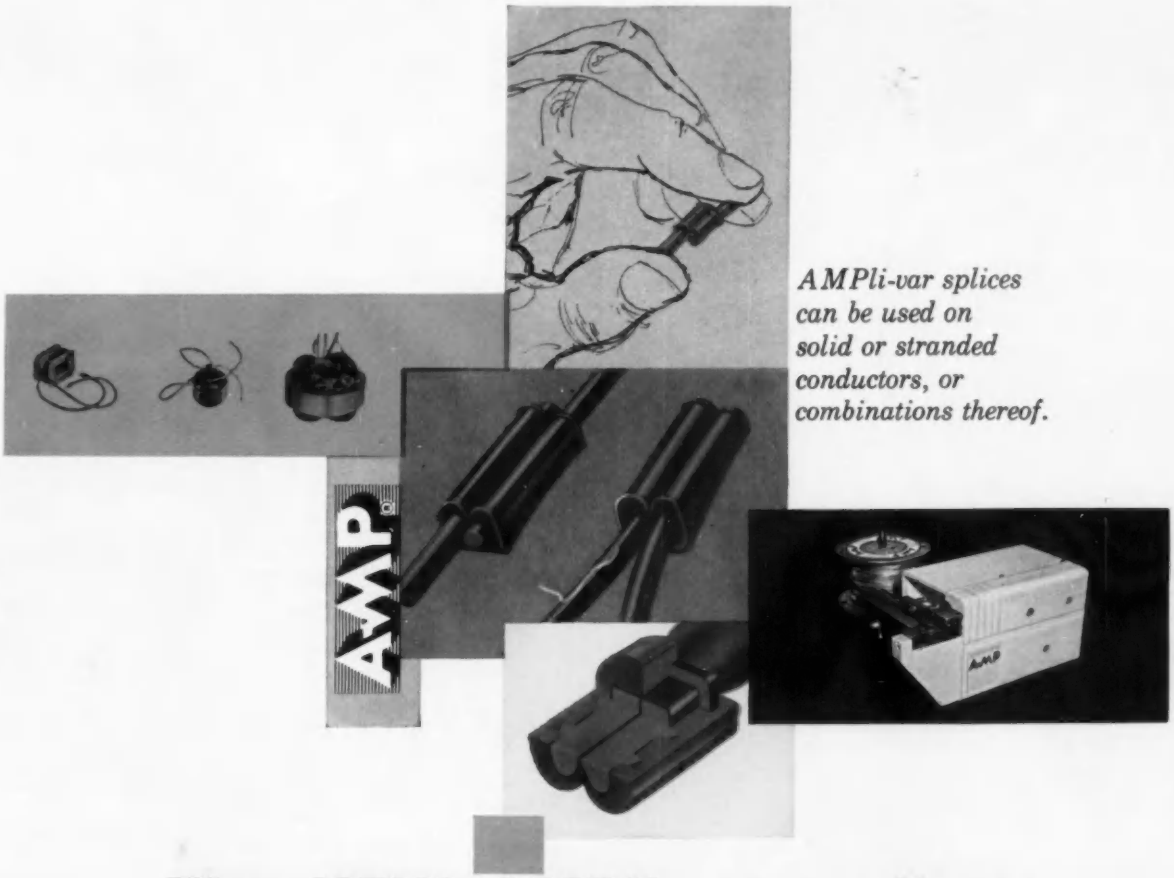
American Foundrymen's Society, 1958 Foundry Show, Cleveland Public Auditorium, Cleveland, O. .....May 19-23

International Federation of Automobile Engineers and Technicians, International Technical Congress, Paris, France...May 19-28

National Science Foundation Conference on Research and Development, Shoreham Hotel, Washington, D. C. .....May 20

Indianapolis Race, Indiana .....May 30

Magnesium Association, West Coast symposium on magnesium applications in aircraft and missiles, Institute of Aeronautical Sciences Bldg., Los Angeles, Calif. .....June 4-5



AMPli-var splices can be used on solid or stranded conductors, or combinations thereof.

The NEW AMPli-var splice

for identical, mass produced splices of enamel, poly-vinyl acetal and similarly coated wire

The cutaway of the AMPli-var splice shows how the conductor material and serrations are bonded by extrusion for added strength and electrical contact. The splice is as corrosion resistant as the wire itself.

The AMP Horizontal Automachine . . . ideal for assembly line production . . . uses AMPli-var splice connectors in strip form, for automatic splicing as fast as the operator can insert the wires.

AMPli-var splices, with multiple ring stripping action, eliminate scraping, dissolving in solvents, burning, or other methods for removing insulation. Included among its many other features are:

NO HEAT DAMAGE TO WIRE OR INSULATION—as often occurs in alternate methods of splicing.

SMALL SIZE—scarcely larger than the wires themselves, but design-engineered to lock wire and connector into a high tensile strength splice.

CORROSION RESISTANT—the joint is hermetically sealed during splicing.

LOWER INSTALLED COSTS—eliminates soldering materials and equipment . . . requires less wire . . . reduces time required to make the splice.

Further information is available on request.

AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

A-MP products and engineering assistance are available through wholly-owned subsidiaries in: Canada•England•France•Holland•Japan

BENDIX SELF-ADJUSTING BRAKES ADD TO THE SAFETY AND ECONOMY OF THESE TWO GREAT CARS

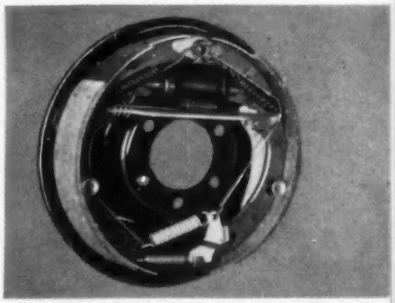
Mercury and Edsel for 1958 feature Bendix' latest development—brakes that adjust themselves!

The new Bendix* Self-Adjusting Brakes not only save the bother and expense of periodic brake adjustments but are safer, too. Stopping power is maintained at maximum because all four shoes are always correctly adjusted. And the driver is assured of effective brake applications because there is always maximum clearance between pedal and floor.

Reasons such as these make Bendix Self-Adjusting Brakes a real sales feature for any car. We predict you will hear more about them in the years ahead.

For over thirty years Bendix Products Division has demonstrated its ability not only to meet, but to anticipate the needs of the automotive industry. From four-wheel brakes to power braking and power steering, Bendix has pioneered and developed many of the industry's most notable advancements.

*TRADE MARK



When shoe clearance exceeds a predetermined amount, a ratchet sets up the star wheel adjuster one notch as the brakes are applied while the car is in reverse. This automatically compensates for lining wear, adjusting the shoes to exactly the right fit within the drum.

Bendix PRODUCTS DIVISION South Bend, IND.

Bendix AVIATION CORPORATION

AUTOMOTIVE INDUSTRIES

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High Spots of This Issue

▼ Air Spring Assembly At Cadillac

A detailed description of the assembly of air spring components at Cadillac Div. is contained in this article. Also included are major steps in the assembly of the unique Cadillac grille. Page 50.

▼ Powder Metallurgy

The automobile provides the largest single market for powder metallurgy parts, largely because such parts can be made to exact dimensions within close tolerances by molding the powders and controlling the shape of the compacts during sintering. Page 54.

▼ Continental's Fuel Injection

A new fuel injection system for business aircraft is designed for ready adaptation to engines of widely varying power ratings, displacement, and number of cylinders. The four basic system elements are explained here. Page 58.

▼ New Body Plant at Vauxhall

General Motors' $100 million expansion program at its Vauxhall plant in Britain aims to almost double production. Major project of the program is the new Luton body plant, believed to be one of the most modern of its kind in Europe. Page 62.

▼ New Static Switches at Westinghouse

Westinghouse Electric Corp. recently unveiled a new plant specially built for the manufacture of semiconductors. Among the new products to be turned out here are a high-temperature semiconductor rectifier and a new series of silicon transistors and silicon switches. Page 68.

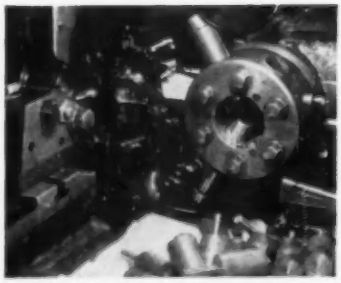
▼ 43 New Products Items And Other High Spots, Such As:

Convair 880, Leyland bus, construction equipment report, automotive financing, Airslide conveyor system, ASTE show, and industry statistics.

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES • BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY • PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT • SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
ENGINEERING • PRODUCTION • MANAGEMENT

Short, fast-breaking chips indicate machinability of Rycut 20 —also save time by eliminating problems of chip clearance.

Rycut 20 alloy steel increases rotor output 40%, doubles tool life



Using Rycut 20 bars, Buckeye Tools Corp. machines motor rotors in less than two minutes floor-to-floor time.

Here's a manufacturer getting 34 rotors an hour compared with a previous 24—plus a 100% reduction in tool grinding.

How? By switching to Rycut 20 alloy steel. The company is Buckeye Tools Corporation, of Dayton, Ohio. A Ryerson alloy specialist recommended Rycut 20 (a low-carbon, lead-bearing alloy) for the rotor of their "Cadet" nibbler, an air-operated contour-cutter used on sheet metal, tubing and plastics.

World's fastest machining alloy steel in its carbon range, Rycut 20 is widely used for gears, cams, spindles, shafts and bearings. Like all other alloys from Ryerson, it carries a Certificate of Analysis and Hardenability which tells you exactly what steel you're getting and what to expect of it. A phone call to a Ryerson steel specialist at your nearby Ryerson plant may bring important cost reductions in your metalworking operations.

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Principal Products: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing—aluminum, industrial plastics, metalworking machinery, etc.

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News

OF THE AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 118, No. 8 **April 15, 1958**

Exports Drop Despite Increase In South American Shipments

U.S. automotive exports dropped 10 per cent during 1957, despite a healthy 28.1 per cent increase in shipments to South America.

Vehicle shipments outside the U.S. totalled 335,197 units last year, a drop from the 372,442 a year ago. The 1957 total included 141,381 passenger cars, 6072 buses and 187,744 trucks.

All three categories were down from the previous totals of 174,895 cars, 7115 buses and 190,432 trucks. These figures include built-up vehicles and knocked-down (KD) units shipped for overseas assembly. KD units in many cases are only partial vehicles that are completed abroad with nationally produced components.

Canada, the industry's best customer a year ago, fell into sixth place in 1957, with 22,895 units compared to 49,388 units in 1956.

Exports to our South American neighbors jumped from 87,279 a year ago to 121,280 last year. The big increase was in trucks—from 56,986 to 85,776. Venezuela, Argentina and Brazil accounted for more than 67,000 trucks.

Mexico became the No. 1 customer for U.S. automotive products last year, taking 40,084. Included were 20,080 trucks and 18,559 passenger cars, plus 1445 buses. Even so, Mexico's total was some 4300 less than in 1956.

Brazil, with its huge construction programs, was the top truck importer, buying 27,134 units. Oil-rich Venezuela was the prime passenger car customer, taking 19,709 cars. But this was a long way from the 38,506 passenger cars shipped to Canada the year before.

An interesting sidelight to the 1957 export figures compiled by the U.S. Dept. of Commerce and the Automobile Manufacturers Association was the breakdown on Iron Curtain shipments.

A total of 186 vehicles found their way into Iron Curtain countries during 1957. Yugoslavia, with 145 cars and 31 trucks, was the leading importer. Czechoslovakia received two trucks and two passenger cars, and Poland, China and the USSR each received two passenger cars.

With the possible exception of the Yugoslavian shipments, all of the Iron Curtain sales undoubtedly were to American State Dept. employes.

Taunus 5-passenger sedan has overall length of 172.2 in.

Ford to Import German Taunus In New Bid for Small Car Sales

Ford Motor Company will put its German-built Taunus automobile on sale in this country next month, broadening the company's coverage of the small car field.

The Taunus, like Ford's line of small English cars, will be handled in this country by the M-E-L Div. First U.S. showing was at the International Automobile Show earlier this month in New York.

Ford still has not announced plans for building a small car of its own in this country, although such a car is being readied. Acceptance of the 102.5 in. wheelbase Taunus may have a bearing on Ford's eventual small car decision.

The Taunus will be available in six models: 17-M deluxe and standard four-door sedan, 17-M deluxe and standard two-door sedan, and deluxe and standard two-door Combi-Wagon.

Utilized body construction is used in the Taunus, and power comes from an overhead valve, four-cylinder engine with 67 bhp at 4400 rpm. Displacement is 103.62 cu in. and compression ratio is 7.1 to 1.

Overall length of the Taunus is 172.2 in., width is 65.7 in., and height is 57.7 in.

A three-speed synchronized transmission is standard, and an automatic clutch called the Saxomat comes as an extra cost option. The Saxomat permits shifting gears without a clutch pedal. An electric control switch in the gearshift level actuates the magnetic clutch-operating mechanism automatically.

NEWS AUTOMOTIVE AND AVIATION

CITROEN 2CV AVAILABLE IN QUANTITY IN U.S.

Citroen 2CV, a low-cost economy car, is now being made available in quantity for the first time in the U.S. The car is currently being sold in Europe for delivery in 1960. The 2CV, which retails here for $1298, is powered by a two-cylinder air-cooled engine.

AMC Finally Gets Contract To Produce the Mighty Mite

After nearly four years of waiting and negotiating, American Motors has received a government contract to build the Mighty Mite, the corporation's 1500-lb military utility vehicle.

AMC is getting a $5,578,720 contract to produce 250 of the lightweight vehicles. The Mighty Mite will be built in the Detroit area by AMC, although actual production will not begin for nearly a year.

AMC purchased the vehicle rights from Mid-American Research Corp. of Wheatland, Pa. The engine, however, was designed and developed by American Motors.

And it's the V-4 air-cooled aluminum engine that holds the key to AMC's future with the Mite. It appears that the company is more interested in the engine, and its possible uses, than in the vehicle itself.

The V-4 could find its way into extensive industrial use, and perhaps some commercial vehicle application, now that a means has been found to finance tooling and production startup. The government contract represents a stepping stone to commercial production of the compact, light engine.

George Romney, AMC president, announced a few months ago the disbanding of the Special Products Div., which had been set up originally to handle AMC's defense production. Now the Mighty Mite probably will be built by the automotive division.

There had been some speculation that the Mighty Mite, if it ever materialized, would be built in the Kelvinator Div.'s Plymouth Road compressor plant in Detroit. The company at one time built aircraft engine and helicopter components in the plant. Nearly all of the former Hudson Motor Car Co. plant sites now have been disposed of.

The engine, which weighs only 200 lbs, develops 62 hp at 3600 rpm and 90 lb/ft torque at 2500 rpm. Displacement is 108 cu in., compression ratio is 7.5 to 1, and bore and stroke measure 3¼ x 3¼ in.

The engine has a high aluminum content with all aluminum parts except the intake manifold and pistons designed for die casting.

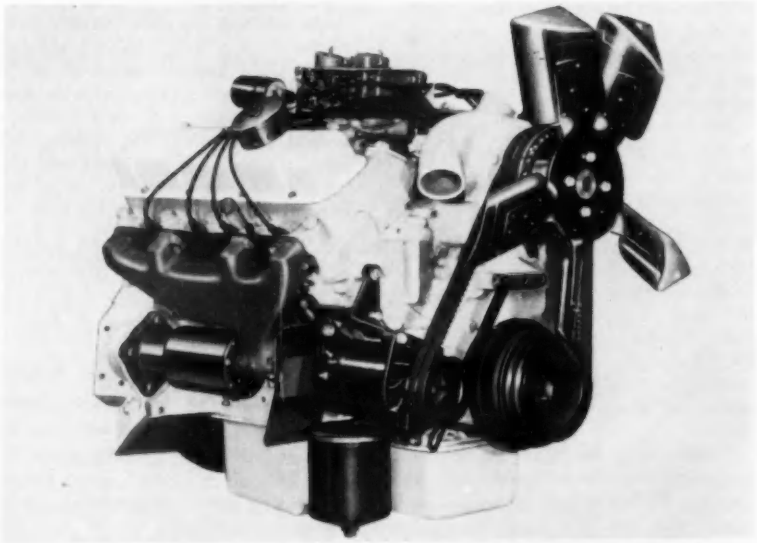
Cooling is by a 9-in. blower at the engine front. The blower support is bolted directly to the timing cover. Air from the belt-driven blower leads straight to the heads, while cylinder air goes first through the central oil cooler.

Conversion to stationary or conventional automotive application would be a relatively simple matter, with perhaps a thermostat change, a revision of the exhaust manifold and a few other minor alterations.

The V-4, which measures approximately 2 x 2 x 2 ft, is set up for 4, 6 or 8-cylinder arrangement, either in Vee or horizontally opposed.

Esso Research Develops New Synthetic Rubber

Esso Research and Engineering Co. has invented and developed a new polymer synthetic rubber that it says



FORD UNVEILS NEW SUPER DUTY INDUSTRIAL ENGINE

This new Super Duty industrial engine, one of four new industrial engines recently added to the Ford line, has a displacement of 534 cu in. and a compression ratio of 7.5 to 1. It develops 252 bhp at 2800 rpm, and has a torque rating of 492 lb/ft at 1700-2200 rpm. The engine features high turbulence wedge-shaped combustion chambers, a new fuel induction system, and a new fuel pressure lubrication system.

can triple the life of key equipment used in manufacturing tires.

Esso officials reported that the new polymer withstands high temperatures, can be cured rapidly, is compatible with both natural and other synthetic rubbers, resists distortion, and is less vulnerable than other rubbers to harmful chemicals in the air.

In demonstrations of the product's heat resistance, the company said an average of 625 automobile tires was produced with curing press bladders made of the new synthetic. With conventional bladders, only about 200 tires can be cured before the bladders wear out. (In modern tire-making, inflated bladders are used to push the tire into shape against the mold and keep it there during the curing process.)

The company said plans are under way for commercial-volume production of the new synthetic, which is known as MD 551.

NEW JAGUAR ROADSTER UNVEILED AT MOTOR SHOW

New Jaguar XK 150 roadster had its first public showing in U.S. at International Motor Show early this month. New features include four wheel disk brakes, one-piece windshield and disappearing convertible top. The six-cylinder 210 cu in. XK engine develops 210 bhp at 5500 rpm and has a compression ratio of 8 to 1. It is available with four-speed manual transmission, manual transmission with overdrive, or Borg Warner fully automatic transmission.

Swedish Automobile Production Totaled 71,654 Units in 1957

Swedish automobile production totaled 71,654 units in 1957, up from 57,274 the year before. Included in last year's total were 52,367 passenger cars, 1948 buses and 17,339 trucks.

Exports totaled 28,092 vehicles, of which 18,812 were passenger cars. U.S. markets received some 12,000 vehicles. But imports, totaling 103,878 units, far outweighed exports.

A year ago Swedish automotive factories built 37,849 cars, 1910 buses, and 17,515 trucks.

Study Group Will Recommend Standard Machine Tool Specs

A five-man study group representing Ford Motor Co., General Motors and Chrysler Corp. is preparing a report that will recommend standardization of dimensions and specifications of machine tools.

The group, which has been working with 26 of the largest machine tool builders in the automotive field, probably will submit its standards report next summer to the National Machine Tool Builders Association. The committee has been studying such dimensions as length and width of unit bases, mounting centers, work heights, etc.

Increased use of complex automatic transfer machines prompted the study. The group hopes to be able to facilitate interchange of heads, bases, and other machine tool components so that new automotive products will not always require complete new machines.

According to a Ford Motor Co. spokesman, some of the 26 cooperating machine tool builders already are working with common specifications.

It is believed that big manufacturers will get greater mileage from machine tool investment under such a set of standards, and that smaller manufacturers will find tooling less of a cost problem since a machine will be used for a wider variety of products.

Motor Wheel Sales Increase But New Earnings Decline

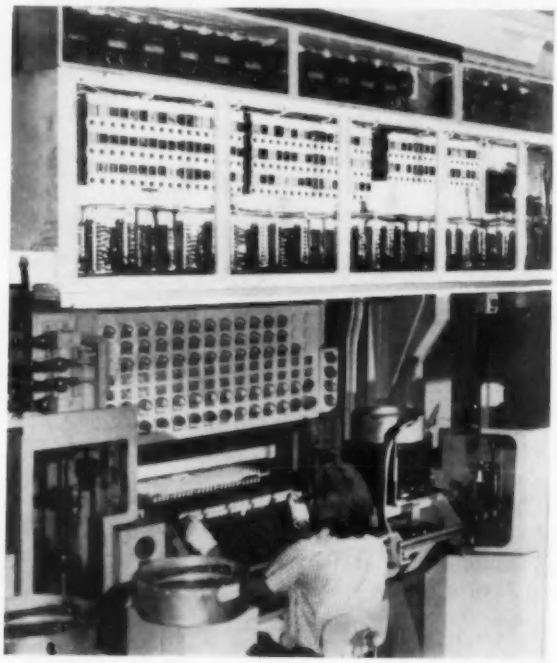
Motor Wheel Corporation reports 1957 sales of $64,726,638 and a net loss of $804,392 after a $700,000 tax carryback. A year ago sales were $61,456,638, but the company showed a profit of $1,439,404.

Although the company's automotive division sales increased 11 per cent during 1957, losses in the appliance division were "substantial."

POLISH SMYK HAS UNIQUE SUSPENSION

Polish Smyk has a bottom-hinged front body panel that tilts forward to give access to the single bench seat. Suspension on this prototype is by an arrangement of torsion bars that eliminates need for shock absorbers. Friction between the twisting bar and its housing gives the damping effect. The rear-mounted engine develops 15 bhp at 5500 rpm, and drives through a four-speed transmission to give the 500-lb car a top speed of 50 mph.

News AUTOMOTIVE AND AVIATION



STATIC CONTROLS

Spark plug assembly machine with static control has reduced downtime at General Motor's AC Spark Plug Div. plant in Flint, Mich. Built by Helfrecht Machine Co., this unit uses a control panel composed of 127 General Electric Co. static control logic elements. Operator is shown loading base and ceramic cores on the machine. Static control panel is in upper half of picture.

Army Placing $100 Million Truck Order With Four Firms

The Army is placing military truck orders worth $100 million with four vehicle manufacturers, and negotiating with additional manufacturers for more truck and trailer contracts.

Army Secretary Brucker announced the following contracts were being completed: Chrysler Corp., 3200 ¾-ton trucks and 1000 one-ton vehicles; Willys Motors, Inc., 250 Mechanical Mules; Utica-Bend Div., 5000 2½-ton trucks; and Mack Trucks, Inc., 32 heavy vehicles.

Contract negotiations also are being completed for 3000 five-ton trucks and 500 trailers and semi-trailers. The Secretary said the Defense Department still had $222 million to be awarded for military equipment before July.

Predict 27 Per Cent Drop In Car Industry Spending

The automobile industry will spend approximately 27 per cent less during 1958 on new plants and equipment, although an upward swing will be detected during the final six months of the year.

Recent figures from the U.S. Department of Commerce forecast plant and equipment outlays totaling $768 million during 1958. This would be the lowest figures since 1950, when capital expenditures totaled $510 million.

Chrysler's Auto-Pilot Cars Hit the Road This Month

Dealers began receiving shipments this month of Chrysler and Imperial cars equipped with Auto-Pilot, a power assist which permits the driver to remove his foot from the accelerator when cruising on the open road.

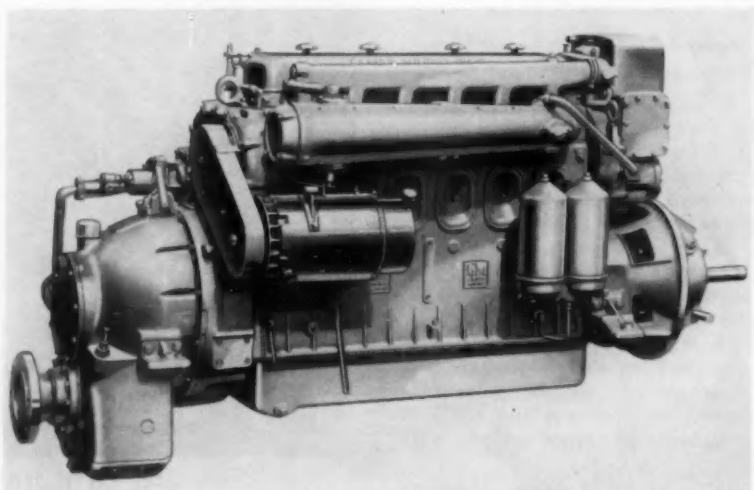
Both the Detroit and Los Angeles Chrysler plants began shipping Auto-Pilot cars this month. Division sales vice-president Clare E. Briggs says Chrysler is set up to produce 1000 cars a month with the automatic speed regulator.

Auto-Pilot was first announced last fall when Chrysler introduced its 1958 models, but volume production was held up until now.

To operate the Auto-Pilot, the driver sets his desired speed on a dial on the instrument panel. When the set speed is reached the driver can remove his foot from the accelerator, and the device holds the speed until a touch on the brake pedal releases the Auto-Pilot.

Although the Auto-Pilot is somewhat reminiscent of the old-fashioned dash-mounted throttle, it is more than just a throttle. The device makes automatic adjustments for hills, giving more gas on an upgrade.

Chrysler predicts greater use of its Auto-Pilot in the future as more miles of limited access highways are completed under the Federal Interstate Highway system.



DETROIT DIESEL DISPLAYS NEW SIX-CYLINDER MODEL

This new six-cylinder work boat model was featured in Detroit Diesel Engine Div.'s display at the National Motor Boat Show recently. One of the division's Series "E" engines, the new model is said to attain up to 15 per cent more continuous horsepower with no increase in fuel consumption. Engine is rated at 170 continuous shaft hp.

NAVY FLUOROSCOPE

Chance Vought Aircraft, Inc. is using this Navy fluoroscope to check flaws in magnesium and aluminum castings. Operator in lead shielded booth sees x-ray view of castings in middle of viewing window. Wheels at bottom move casting so that it can be viewed from all angles.

Last year, expenditures totaled about $1.058 billion.

Although 1958 looks like a low-spending year, there are indications of a pick-up by year's end. Commerce Department predicts outlays of $378 million during the first half of the year and $390 million during the second six months.

This is just the reverse of the spending trend during 1957, when a sharp cut was made in the fourth quarter. In fact, the first six-month total was $611 million and the second-half figure dropped to $447 million. During the final quarter of the year, only $195 million was spent.

Capital spending by the automobile industry hit an alltime high of $1.649 billion in 1956.

General Motors will spend an estimated $430 million this year, and Ford about $225 million. Chrysler says it will spend about $96 million. In 1957, these three companies spent $474 million, $376 million, and $96 million respectively.

James Cope Resigns as Chrysler Market Planning Vice President

James Cope has resigned as Vice President - Market Planning of the Chrysler Corp., becoming the second Chrysler V.P. to leave the corporation within a week. Robert T. Keller's resignation was announced just five days earlier.

Mr. Cope, a former newsman, joined Chrysler in 1944 as assistant to the president. He became a corporation vice president in 1952.

AI TABLOID

Timken Roller Bearing Co. is spending over $3 million to modernize the cup and cone grinding departments of its Canton and Columbus, O., plants, and for new major equipment for its Bucyrus Bearing Plant.

* * *

Pangborn Corp. developed a new steel blast cleaning abrasive, called Rotoblast Steel Shot, that is said to have a narrow hardness range, extreme uniformity, density and toughness. The new abrasive is shotted by a vacuum-cast method and then goes through a continuous heat treat in a controlled atmosphere.

* * *

Hoover Ball & Bearing Co. purchased Ahlberg Bearing Co., a subsidiary of Maremont Automotive Products, Inc., and will move the acquired assets to its new bearing plant now nearing completion outside Ann Arbor, Mich.

* * *

General Tire & Rubber Co. is producing a new semi-rigid vinyl sheeting for vinyl-to-metal applications. Known as Boltaflex 500, the new plastic is capable of standing up under every machining or fabricating process used in metalworking, and will resist wear, stains, cracking, weather or salt water corrosion, and other causes of deterioration, the company says.

* * *

Johns - Manville Corp. consolidated all its friction material activities under one central management. A special district office will be established in Detroit to serve the automotive equipment field.

* * *

Chicago Pneumatic Co.'s Utica, N. Y., plant built a 17,000-lb "hot dimpler" for Bell Aircraft Corp. The new machine, which is designed specifically for critical aircraft applications, develops 100,000 lb of pressure while preheating the immediate area around the rivet hole to 1000 F.

* * *

United States Chemical Milling Corp. is expanding its West Coast facility to house its newly acquired subsidiaries — Missile-Air Corp. and Hydro-Metal Spinning Corp.

National Research Corp. scientists say they are now operating ultra-high vacuum test chambers at pressures of 10^{-10} millimeters of mercury, or about one-trillionth of atmospheric pressure. In effect, this is a sample of near space equivalent to 400 miles above the earth's surface.

* * *

Bendix-Skinner Div. of Bendix Aviation Corp. changed its name to Bendix Filter Div., and the division's West Coast Poroloy Equipment, Inc. plant will now be designated as the West Coast Branch.

* * *

Eastman Kodak Co. announced a new industrial x-ray film that is about 50 per cent faster than the fastest Kodak industrial x-ray film now available. Called Kodak Industrial X-ray Film, Type KK, it is expected to cut exposure time in such applications as marine propellers or large steel castings.

* * *

Norton Co. and Carbometal, S.A. of Mendoza, Argentina formed a new company to promote silicon carbide for the Argentine market. Called Norton Casali, S.A., the company will build a $500,000 electric furnace plant on a ten-acre site in Mendoza.

* * *

Sundstrand Machine Tool Co. bought Arter Grinding Machine Co., Worcester, Mass., makers of cylindrical grinders, rotary surface grinders, special machine tools, and a tape-controlled positioning table. Purchase price was not disclosed.

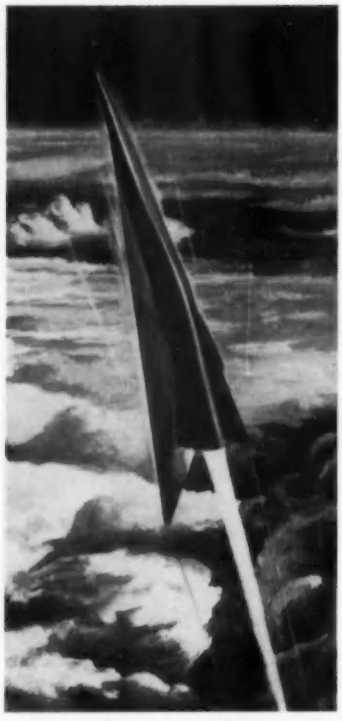
* * *

Le Roi Div. of Westinghouse Air Brake Co. sold its commercial engine business to Waukesha Motor Co. and announced that it will concentrate on its air compressor lines.

* * *

Du Pont Co. is constructing a new plant at its Washington Works, Parkersburg, W. Va., for Teflon 100-X, a new fluorocarbon resin that can be extruded and molded into such products as insulated wire, electronic components, tubing, and linings for process equipment. The new resin is expected to be in commercial production by the middle of 1959.

AVIATION MANUFACTURING



Artist's concept of manned hypersonic rocket glider

Propose Manned Rocket Glider Launched from 2-Mile Track

Ryan Aeronautical Co. proposes a manned hypersonic rocket glider that could be used to explore space. The vehicle would be launched from a two-mile-long track and travel at speeds as high as 18,000 mph.

The proposal is contained in a paper presented last month (March) at a secret symposium on high-speed dynamics and structures sponsored by the Air Force, University of California, Convair Div. of General Dynamics, and Ryan. The paper was presented by Vjekoslav Gradecak, Ryan structures engineer.

Mr. Gradecak explained that the glider would be secured to a sled platform containing rockets that would be fired in sequence by the pilot until a speed of 500 mph is attained. The rocket's own liquid-fuel power would then cut in, the rocket would simultaneously disengage from the sled, and the vehicle would climb to about 100,000 ft. It would then level off and gain speed in a more gradual climb until its engines burned out at an altitude of about 200,000 ft. At this time the glider would be traveling at between 15,000 to 18,000 mph.

From this point, Mr. Gradecak said, the glider would begin a gradual descent to earth. The pilot would be able to control only the vehicle's attitude to prevent tumbling, through the use of a small amount of jet fuel to supply jet nozzles in the wing.

The pilot would be able to control the glider aerodynamically when it slowed down to a speed of 2000 mph at about 100,000 feet altitude, and guide it back to a landing.

The Ryan engineer explained that the "slingshot" method of launching means enormous savings on the amount of fuel needed to get a conventional rocket off the ground.

He also pointed out that Ryan's recently developed MiniWate method of fabricating a paper-thin, high-strength steel alloy could be used in developing such a rocket glider. The new alloy, a combination of welded corrugated and flat skins, can withstand the extremely high temperatures generated by a vehicle traveling through the air at hypersonic speeds, he said.

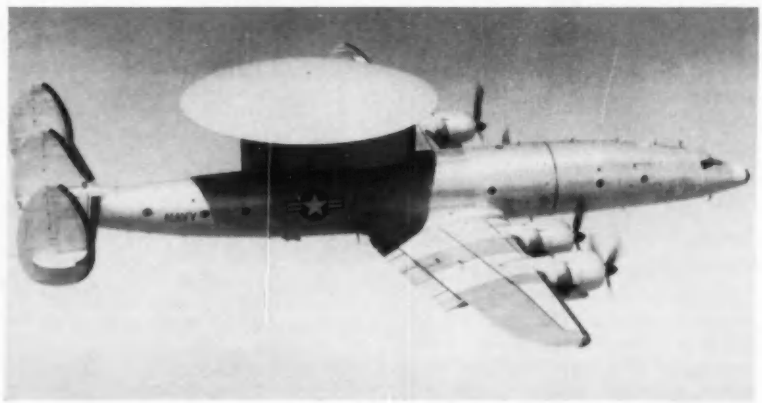
X-15's Skin and Wings Are Made of New Stainless Steel Alloys

The X-15 rocket plane, which is built to carry a man to altitudes up to 350 miles at speeds as high as 4000 mph, will turn a glowing red as it plunges back into the earth's atmosphere.

To cope with the extremely high temperatures it will encounter, the entire plane's skin and wings will be built of extremely-high-temperature resisting stainless steel alloys containing iron, nickel, and chromium. Stainless steel will also be used for the protrusions that extend nearly the entire length of each side of the fuselage and contain lines, controls, wires, plumbing, actuators, etc.

These and other details of the new experimental craft, described as half plane and half missile, were revealed by the Committee of Stainless Steel Producers of the American Iron and Steel Institute. The X-15 is designed to take man to outer space and back, and to explore such problems as weightlessness, control, and re-entry into the atmosphere.

The committee also revealed that new manufacturing techniques are being used by North American Aviation, Inc., the plane's builder. About 65 per cent of the X-15 will be welded structure and only 35 per cent fast-



NAVY INSPECTS LOCKHEED RADAR RESEARCH PLANE

Lockheed radar research plane got its first close-up inspection by the Naval Air Development Unit at South Weymouth, Mass. Shaped like a flying saucer, the big radome houses antenna for an electronic eye that can do the work of dozens of ground radar stations. The naval unit at South Weymouth will conduct a six-months flight program to evaluate the new equipment inside the aerial picket plane.

ened. The side panels will be chemically milled after forming to save weight. These and other techniques now being worked out on the new metals "will set the pattern for future families of airplanes," the committee said.

North American officials said the X-15 called for more ingenuity in laboratory work than any other plane or missile built by the company because of the unprecedented variations in temperatures which parts will experience simultaneously. The plant's heating rate will be 70 times faster than that of supersonic jet planes. Temperature range will be from about 1000 F down to about 300 F below zero—the temperature of the liquid oxygen fuel. Refrigerated air will be used to cool fluids, components, and systems. The pilot will be in an insulated cockpit that protects him from scorching heat and can also serve as an escape capsule.

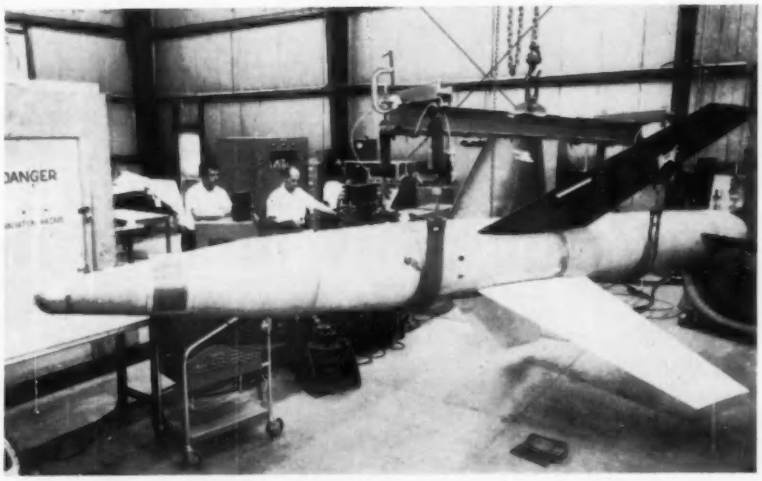
Because conventional controls are useless in the near vacuum, where the X-15 will reach the top of its exploratory arc, ingenious reactions controls will keep the ship in proper attitudes. Controls consist of hydrogen peroxide jet streams in the nose and wingtips, which act just like jets of steam to push the plane in the opposite direction to their force.

The X-15, it was revealed, will land on steel shoes at the end of short struts which pop out from the aft fuselage section. It has a conventional nose section.

The X-15, a joint project of the Air Force, Navy, and National Advisory Committee for Aeronautics, is now being assembled at North American's Los Angeles, Calif., plant. Flight tests of the research craft are scheduled to begin early next year.

MIXED-POWER AIRCRAFT CLIMBS ON ROCKET ENGINE

Saunders-Roe S-R.53 is a mixed power interceptor aircraft with both rocket engine and jet-turbine power units. The plane, shown climbing under its rocket power, carries two Firestreak infra-red guided weapons on the tips of its wings. It is said to be capable of altitudes and speeds well in excess of existing height and speed records. Both of its engines were built by the de Haviland Aircraft Co.



LACROSSE GUIDED MISSILE GETS FINAL CHECK

A Lacrosse guided missile built for the Army gets a final check at Martin Co.'s Orlando, Fla. Div. Lacrosse is an all-weather missile powered by a solid fuel rocket motor. It has an overall length of 19.2 ft. Components of the Lacrosse system, including the missile, a launcher and the guidance system, are mounted on standard Army mobile carriers.

Hughes Starts Production On New Lightweight 'Copter

Production is underway on the first five Hughes Model 269A helicopters ordered by the Army, according to an announcement by Aircraft Div. of Hughes Tool Co.

The 269A, a two-man helicopter developed without the aid of a military contract, weighs only 890 lb empty and carries a 660-lb payload. It has a top speed of 90 mph and cruising range of 150 miles. It is powered by a four-cylinder, air-cooled 180-hp Lycoming engine held in place by four bolts.

The contract was awarded through the AF Air Materiel Command.

The helicopters will be put through operational tests by the Army Aviation Board at Ft. Rucker, Ala., and will be flight-tested by the Air Force at Edwards AFB, Calif.

New Fatigue Testing Device Aids in Design of Aircraft

A unique fatigue testing device developed in Germany by Losenhausen is being manufactured in this country by Riehle Testing Machine Div., American Machine & Metals, Inc. of East Moline, Ill.

The machine is capable of imposing repeated stresses upon a structure as large as an airplane wing, under a range of controlled conditions and recording the results.

The unit is a hydraulically actuated, axial-loading device that can make both compression and tension tests, statically or dynamically. Current models have dynamic capacities ranging from 12,000 to 200,000 lb, or static loads up to 400,000 lb, but machines of higher capacity can be built to order, the company says.

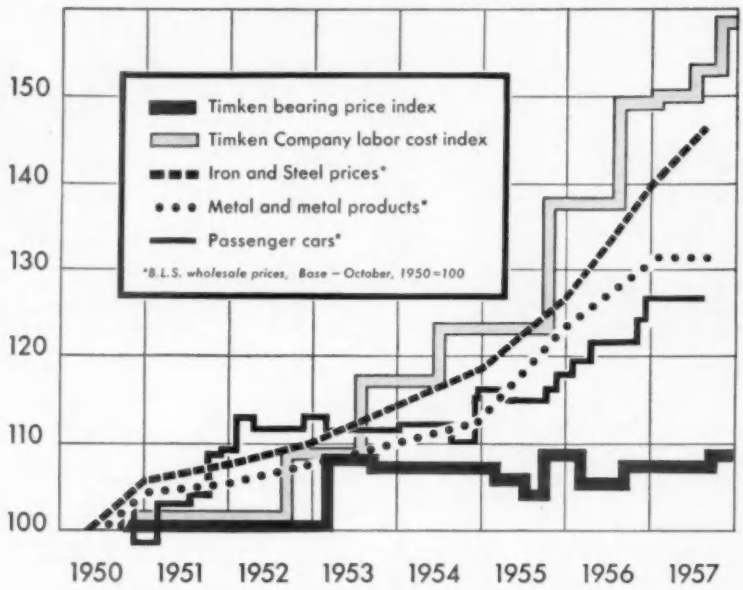
The stroke is infinitely variable from zero to maximum capacity of the pulsator; frequency is also variable.

The load can be applied as a fluctuating load, with high and low values, in either tension or compression; or as an alternating load, running

Continued on Page 102

Here's the low-down on bearing costs

You name it—just about everything's gone up in price. (See chart.) But Timken® tapered roller bearings for passenger cars have held the line. You helped keep the cost down by standardizing on new design Timken bearings made by revolutionary new techniques that have industry buzzing. (See recent articles in dozens of industrial trade magazines.)



TOTAL VEHICLE COST OF PINION, DIFFERENTIAL, REAR WHEEL AND FRONT WHEEL BEARINGS

Here's the way to keep them low-down

These machines are part of the unique new Bucyrus, Ohio plant that gains the savings of full-tilt, non-stop, highly mechanized production. This missile age plant can *keep* your bearing costs down if you: 1) standardize on even fewer of the new Timken bearing sizes and 2) use more Timken bearings, the bearings made with cost-cutting techniques. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

BEAT INFLATION WITH STANDARDIZATION...

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

MEN IN THE NEWS

Fairbanks, Morse & Co. — Charles F. Doepke was appointed manager of advertising and public relations.

Cincinnati Milling Machine Co.—Curtis Altbaier was appointed manager, special machine tool sales; and Carl Schonhoft was named manager, grinding machine sales.

A. Shrader's Son Div., Scovill Mfg. Co., Inc.—Phillip Hall has been named manager of industrial sales.

Ac Spark Plug Div., General Motors Corp.—**O. Franklin Frost** was appointed sales manager, succeeding K. K. McGarvey.

White Motor Co.—**Henry J. Nave** was elected executive vice-president.

Olin Mathieson Chemical Corp. — **John M. Welch** has been appointed director of field sales for Olin Aluminum.

Hercules Motors Corp.—**Ralph E. Evans** has been made assistant manager of distributor sales and **Harry Cuthbert,** assistant chief engineer for the new line of air-cooled engines.

American Brake Shoe Co., Denison Engineering Di v.— **Don Arnold** has been promoted to manager of the Detroit District Office at Birmingham, Mich., and **John W. Lindsay** is now Cleveland District Manager.

Goshen Rubber Co., Inc.—**Carroll D. Hobson** was made chief engineer.

Hyster Co.—**Glenn Herz** has been made chief engineer, succeeding **Al Zwald,** retired.

Standard Oil Co. (Indiana)—**Gerald T. Dougherty,** assistant general manager for commercial direct sales and bulk sales, has retired.

Yale & Towne Mfg. Co., Materials Handling Div.—**Roy Perler** was promoted to Eastern Regional sales manager.

Jones & Laughlin Steel Corp., Stainless Steel Div.—**John I. Collins** has been appointed Chicago District sales manager.

Aeronutronic Systems, Inc.—**Joseph V. Charyk** has been appointed director of missile technology, and **Montgomery H. Johnson** was named director of advanced research.

Alan Wood Steel Co.—**George G. Karian** has been appointed manager of iron powder sales.

Townsend Co.—**Robert E. Casner** has become vice-president-sales, Townsend Div., and **George A. Bentley** was named vice-president of Sheffco Mfg. Co., Townsend's newly acquired operation.

Chrysler Corp., Stamping Div. — **Roy Blasiola** was named manager of the Twinsburg, O. Stamping plant; **Wilfred T. Hanlon,** manager of the Outer Drive Stamping plant; and **Walter B. Connolly,** manager of the Mack Ave. Stamping plant.

Chrysler Corp.—**John D. Moran** has been named director-procurement programming.

Huck Mfg. Co.—**Edward J. Walsh** was appointed Philadelphia regional manager.

Cleveland Cap Screw Co.—**C. Beach Powell** has been named sales manager, socket division.

Ford Motor Co., Tractor & Implement Div.—**J. F. Carson** has been named production manager of the Des Moines (Iowa) Implement Plant.

Clearing Machine Corp.—**Lew Murray** was appointed manager of the Contract Department.

Lockheed Aircraft Corp.—**M. Carl Haddon** was named California Div. director of marketing.

Arthur D. Little, Inc.—**Raymond Stevens,** president, has assumed the duties of chief executive officer.

Dayton Rubber Co. — **Harry T. Goodenberger** has been named vice-president in charge of tire sales.

Associated Spring Corp. — **Walter H. Bertram** has been promoted to sales manager of Raymond Mfg. Div.

Seiberling Rubber Co. of Canada, Ltd.—**W. Horace Mason** was elected president and general manager.

Owens-Corning Fiberglas Corp.— **Samuel G. Rae** was named manager of automotive sales.

Imperial Brass Mfg. Co.—W. C. Musham was elected president and treasurer, succeeding F. C. Shafer, who remains board chairman.

Stewart - Warner Corp., John Hobbs Div.—Byron D. Booth was named general sales manager.

Necrology

Fred A. Aston, Sr., 79, retired sales manager for national accounts for Oakite Products, Inc., died Mar. 6, at Lauderdale-by-the-Sea, Fla.

Judson F. Stone, 85, former chairman of International Harvester Co., died recently, at Evanston, Ill.

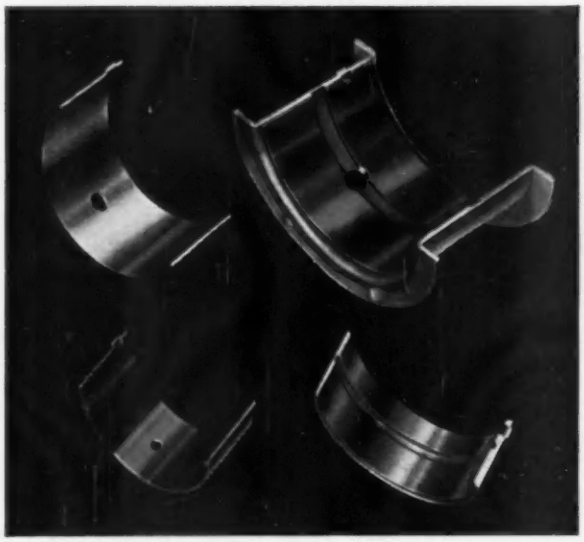
Edmund E. Wegrzyn, 46, traffic manager for Bell Aircraft Corp., died Mar. 10, at Buffalo, N. Y.

Ted E. Allen, manager of Armstrong Hydraulics, Inc., died Mar. 17, at Chicago, Ill.

Earl W. Pughe, 61, former vice-president of Ludlow Valve Co., died Mar. 22, at Key West, Fla.

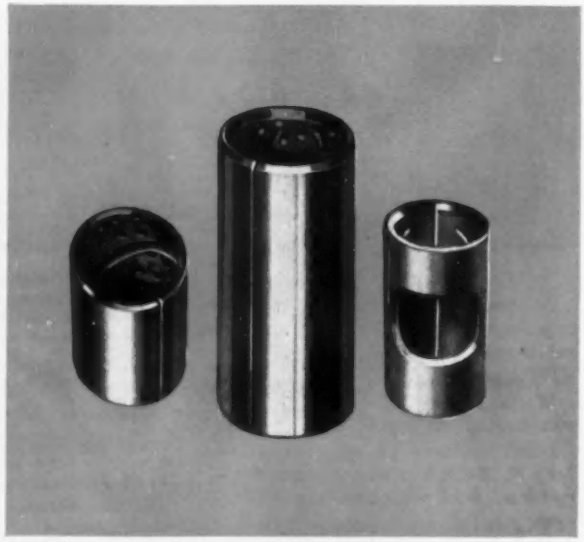
These alloy linings meet 95% of engine bearing needs

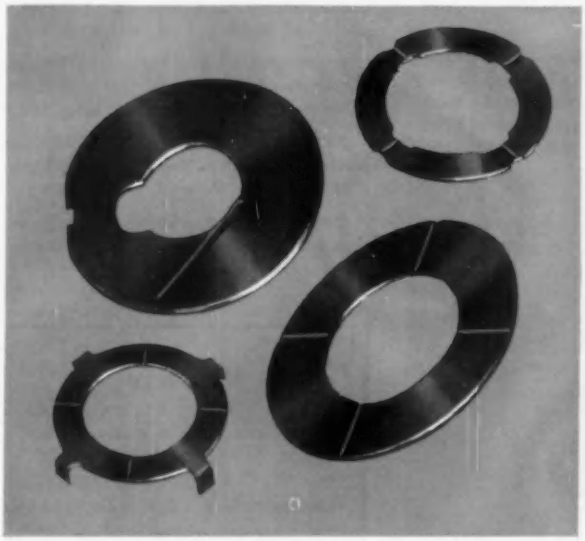
Experience shows a steel back, lined with tin- or lead-base babbitt, medium- or heavy-duty copper-alloy or extra heavy-duty aluminum alloy, meets most performance requirements.



Bimetal and Plain Bushings offer substantial economies

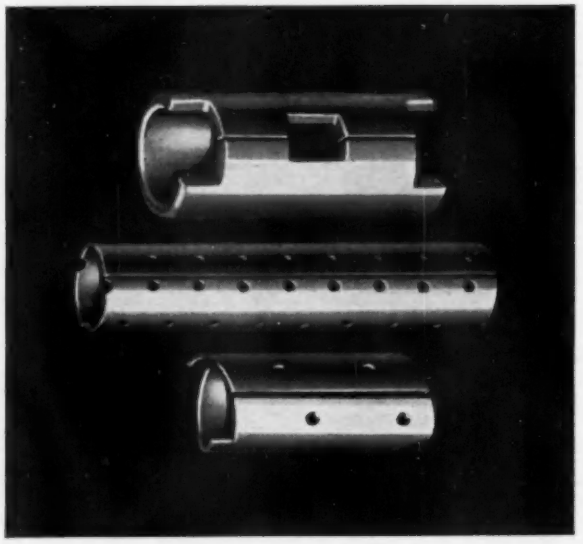
Rolled split plain bronze, steel or aluminum; or steel lined with bronze, babbitt or copper-alloy. Many design variations possible, plus volume production economies.





Precision Thrust Washers in Bronze or Bronze on Steel

Cold rolled for heavy duty. Steel faced with copper-alloy on one or *both* faces. Nibs, lugs, coined oil grooves. Flat, spherical or special shapes. From 1″ to 6″ O.D.



Economical Spacer Tubes for Hundreds of Applications

Money-saving substitute for iron pipe, tubing or machined parts. Delivered ready for assembly, to exact dimensions—or can be brazed to other components.

FEDERAL Mogul SINCE 1899

FEDERAL-MOGUL DIVISION

FEDERAL-MOGUL-BOWER BEARINGS, INC., 11037 SHOEMAKER, DETROIT 13, MICHIGAN

RESEARCH • DESIGN • METALLURGY • PRECISION MANUFACTURING

SELF-LOCKING "PLACE" BOLTS

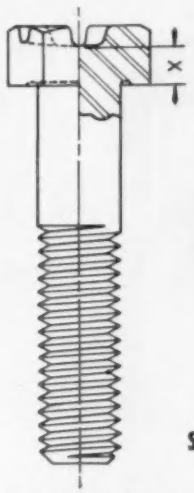
...cut costs...add strength

. . . wherever involuntary loosening or fatigue is a problem!

In some typical automotive and farm equipment applications, for instance, "Place" Bolts are being used as connecting rod bolts, main bearing cap screws, and flywheel bolts.

Here, and wherever a locking bolt may be needed, the Slotted-Type "Place" Bolt offers not only positive locking action but economy and additional strength. It cuts costs because no additional parts or operations are needed. It adds strength because its controlled spring action guards against impact, shock and fatigue failures.

National makes the Slotted-Type "Place" Bolt in carbon or alloy steel, in any of a wide range of sizes. Write us for additional information, including our illustrated folder.



HERE'S HOW SLOTTED-TYPE HEAD LOCKS

The flexible diaphragm formed between slotted segments in the upper face of bolt head and circular recess adjacent to the shank in lower face (section X) acts as controlled spring element when head is properly wrenched against a rigid seat. Diaphragm is reinforced by the continuous-grained segment cold formed between upset slots in upper face.

U. S. Patent No. 2543705

THE NATIONAL SCREW & MFG. COMPANY

Cleveland 4, Ohio

Pacific Coast: National Screw & Mfg. Co. of Cal.
3423 South Garfield Ave., Los Angeles 23, Cal.

National PRODUCTS

Fasteners Hodell Chains Chester Hoists

The launching of the world's third nuclear submarine, the Skate, at General Dynamics Corporation's Electric Boat shipyard. The Skate is the first of four nuclear submarines of its type.

from the SKATE . . .

EXPERIENCE FOR TOMORROW'S AUTOMOTIVE FILTERS

What are the filtration requirements of an atomic submarine? Like any filtration problem, they are a combination of factors, such as: the nature of the fluid to be filtered, operating pressures, temperature, corrosion . . . all of which dictate the filter media and form of the filter. The filters must be engineered to meet the specific requirements of the job. That's why the Electric Boat division of General Dynamics Corporation chose Purolator.

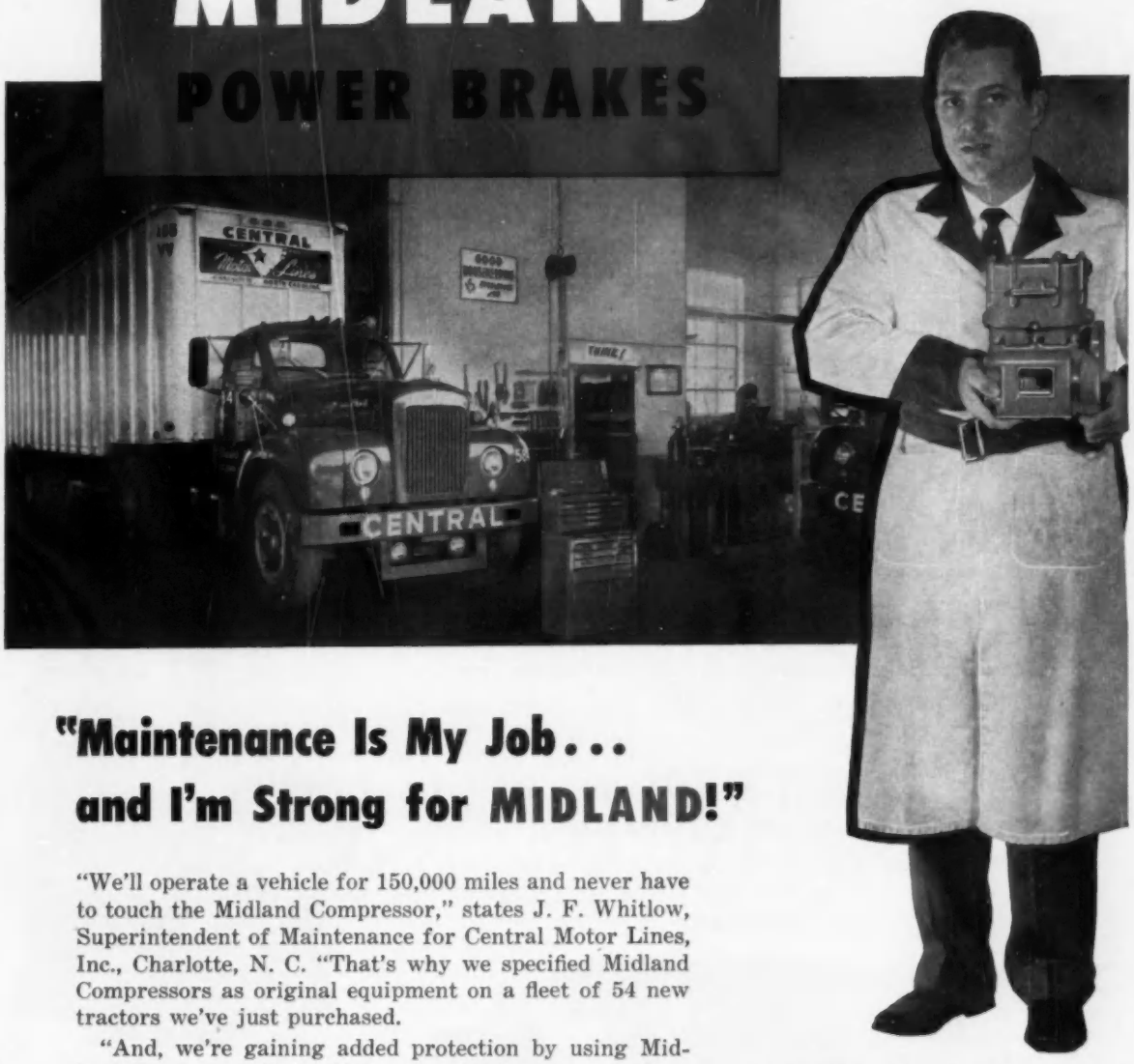
The engineering skills and manufacturing capabilities which make it possible for Purolator to design and build filters for an infinite variety of applications, including nuclear submarines, will produce better automotive filters. In a fast-moving industry, tomorrow's requirements must be anticipated today. Because of its role as designer and builder of filters for all phases of industry, Purolator has, *today*, the experience needed to provide the specific filters you will need for tomorrow's specific requirements.

Your toughest filtration problems are within Purolator's experience.

Filtration For Every Known Fluid

PUROLATOR
PRODUCTS, INC.
RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

MIDLAND POWER BRAKES



"Maintenance Is My Job... and I'm Strong for MIDLAND!"

"We'll operate a vehicle for 150,000 miles and never have to touch the Midland Compressor," states J. F. Whitlow, Superintendent of Maintenance for Central Motor Lines, Inc., Charlotte, N. C. "That's why we specified Midland Compressors as original equipment on a fleet of 54 new tractors we've just purchased.

"And, we're gaining added protection by using Midland Emergency Relay Valves . . . both on new trailers and those adapted to comply with the latest I.C.C. regulations."

For extra savings . . . as well as that extra margin of dependability and safety . . . be sure to insist on Midland Power Brakes. Call your nearest Midland Distributor for the most *complete* line of air and vacuum brakes.

Central Motor Lines, Inc., was founded in 1936 and has its headquarters at Charlotte, N. C. The company has a fleet of 658 vehicles and a network of 17 terminals in North and South Carolina, Ohio and the commercial zones of Chicago, New York and Philadelphia.

M-R
MIDLAND-ROSS CORP.

MIDLAND-ROSS CORPORATION

Executive Offices: Cleveland 1, Ohio

Formerly

THE MIDLAND STEEL PRODUCTS COMPANY

Cleveland • Detroit • Owosso, Michigan

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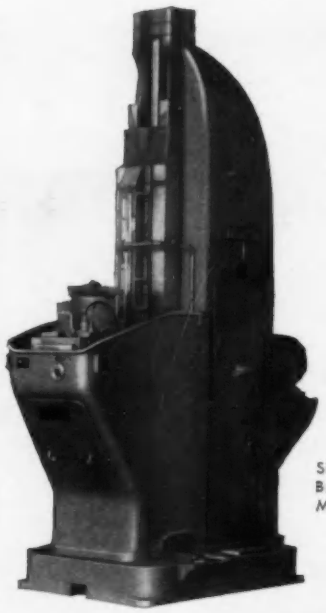
FOOTBURT

a faster

MORE ECONOMICAL

machine operation



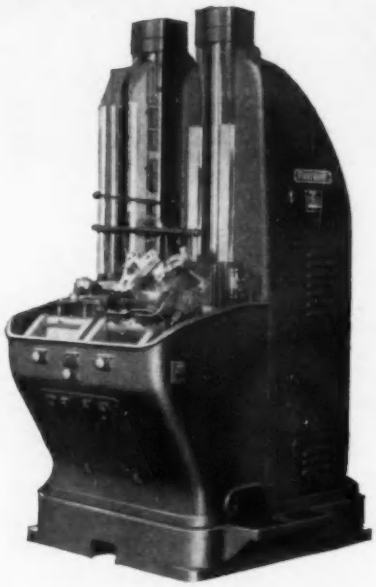
Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

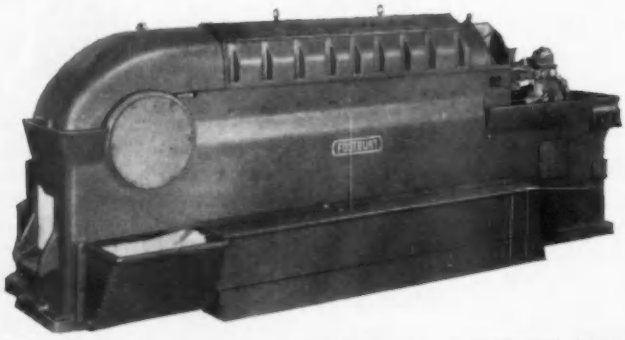
THE FOOTE-BURT COMPANY

Cleveland 8, Ohio Detroit Office: 24632 Northwestern Hwy., Detroit 35, Mich.

Write for Circulars No. 503 and 509



Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.



Continuous Type Broaching Machine. Made in 5 Sizes.

FOOTBURT

PIONEERS IN SURFACE BROACHING

Snap-in headliner with HYPALON® coating adds color and utility to 1958 interiors

A new patented snap-in type of headliner brings a combination of style and convenience to the interiors of a leading 1958 automobile. Prefabricated in ready-to-install panels, this headliner consists of flexible urethane foam which is laminated to panelboard and coated with HYPALON synthetic rubber. The panels snap quickly into place, and are held in position by external bows.

Although applied as a thin coating, the HYPALON plays a big part in the eye appeal of this headliner. HYPALON can be compounded in any one of a wide range of colors to match the car's interior trim. It can be applied by patterned rollers to give the stylist any décor he desires, from Scotch plaid to leopard skin. Because the coating is thin, the fine grained texture of the foam shows through, giving the headliner a soft appearance.

HYPALON adds much to the serviceability of this headliner. If soiled, it can be cleaned with soap and water. And since the coating is a synthetic rubber, it is as flexible as the foam . . . won't crack or flake off when the foam is indented.

HYPALON's combination of these and other important properties has earned it ready acceptance for a variety of automotive applications. Under the hood HYPALON is used for spark plug boots and ignition wire jackets because it resists ozone and high temperatures. Its color stability and resistance to the effects of weathering have led to its use in convertible tops and tire white sidewalls. Consider what HYPALON can do for you. Then, mail the coupon for technical assistance or more information on the varied uses of HYPALON . . . and neoprene, the synthetic rubber made by Du Pont for over 25 years.

ELASTOMERS IN ACTION HYPALON® • NEOPRENE

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Better Things for Better Living
. . . through Chemistry

☐ I am particularly interested in _____

☐ Add my name to the free mailing list for *DU PONT ELASTOMER NEWS FOR AUTOMOTIVE ENGINEERS* (reviews new automotive applications of neoprene and HYPALON).

☐ Add my name to the free mailing list for the *ELASTOMERS NOTEBOOK* (contains articles based on uses of Du Pont elastomers in industry).

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. AI-4
Wilmington 98, Delaware

Name _____

Firm _____

Address _____

City _____ *State* _____

The Convair 880 in Production

MAJOR assembly of the Convair 880, world's fastest airliner, started April 10 at Convair Division of General Dynamics Corp., San Diego, Calif. Additional airplanes will be started at three-week intervals during the initial buildup. Eventually production is programmed at six planes a month.

Construction of the 880 begins with the wing and proceeds without the conventional "major mating" of wing to fuselage. The swept wings are assembled in six large fixtures — sufficient for building three sets simultaneously. After assembly, the wings—two halves at a time—are cured in a mammoth Scotchweld oven to create leakproof, integral fuel tanks. This will take place June 19 on airplane No. 1.

The two half-wings are then brought together by means of a center tie box, and an over-wing barrel and under-wing canoe are attached. As the swept wing moves down the assembly line, successive sections of fuselage are mated.

The start dates for building other major sections of the airplane: forward fuselage canoe, April 14; forward compartment buildup (nose), April 28; and the two aft fuselage canoes, May 12.

The Convair 880 mate line has four stations where these installations are made: aft fuselage and inboard trailing edges; forward fuselage, stabilizers and inboard flaps; final trim and rudder; and pressure test and rigging. These matings will take place during October on the first ship. The first flight of a Convair 880 will be early next year.

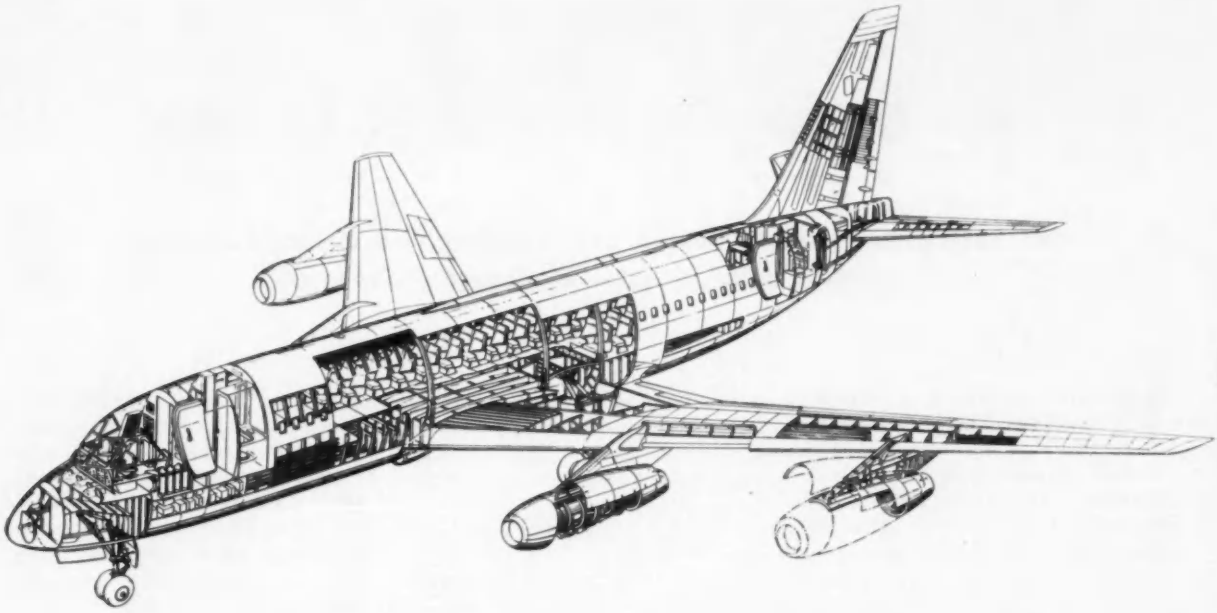
The medium-range aircraft has been designed to operate from the airports that are in use today by four-engine propeller driven planes. With a turnaround time of 25 minutes, including deplaning of passengers, fueling, cleaning airplane and enplaning passengers, the 880 combines all of the advantages to be found in an all jet transport in flight with rapid ground handling operations.

In its first-class configuration the transport will accommodate 88 passengers in two-abreast, wide-aisle comfort. Coach versions will carry up to 109 passengers. Interior design was done by the Harley Earl Corp. The lounge, in the forward portion of the cabin of the deluxe model, will seat as many as 12 people in informal groups.

The reclining arm-chair standard seats are 22 in. wide and are designed with body supporting contours. In the back of each seat is a hinged desk to be used as a writing table or as an individual tray for serving meals. Buffets fore and aft include space for storing hot and cold liquids and prepared food.

Seats are 19 in. wide, as is the aisle, in the 109 passenger tourist configuration. The first-class seating arrangement may be converted completely or in part to tourist seating within two hours. To effect any of a variety of mixed tourist and first-class interiors, airline personnel move the coat closet dividers to any of several pre-arranged lo-

One of the production mockups for the 880 which will be used to form casts to build master and detailed tools including master and tooling gages; assembly, drill and trim fixtures, as well as drop hammer dies, stretch forms and other forming tools.



cations and change the arrangement accordingly. Each row of seats is flanked by two triple-pane windows equipped with glare-control.

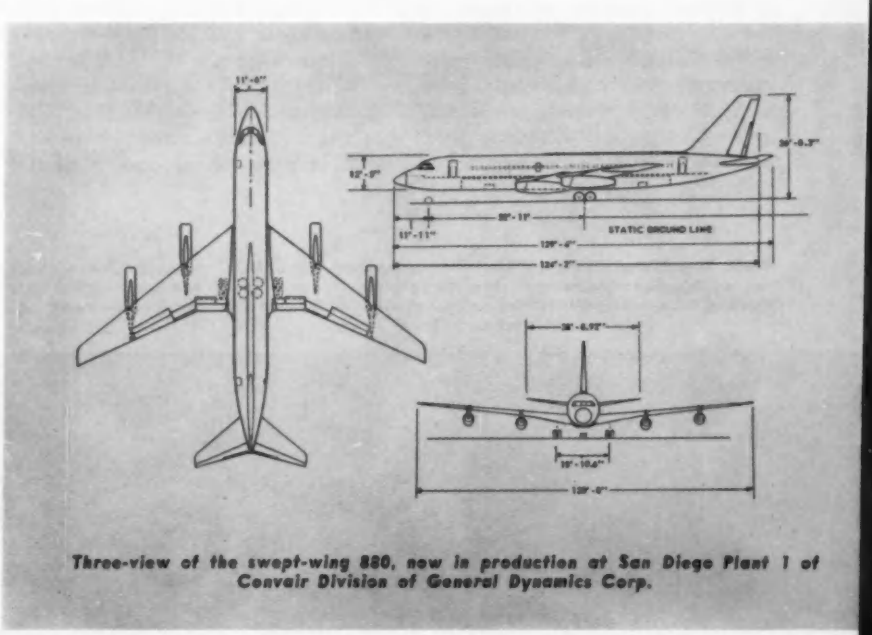
While cruising at altitudes up to 40,000 ft, the Convair's cabin air pressure will be maintained at the 8500 ft level. At 35,000 ft, the cabin altitude will be 6000 ft and at 20,000 ft the cabin pressure will be equivalent to sea level.

The 880 dual air conditioning system will provide a complete change of air every 2½ minutes.

Several mockups have been built including a full-size 880 with a wing, two jet engine pods, empennage and complete interior at a cost of more than $1,000,000. Other mockups of the club arrangement, passenger compartments and various operating details have also been constructed.

Systems, wherever possible are put together in units with a minimum of fastenings, connectors or ducts. This utilization of the "systems package" concept enables a crew of four men to remove an engine and replace it with a new or reconditioned engine in about 30 minutes. Another example of this design program is the Freon condensors used in the air conditioning system which may be removed by loosening four bolts and disconnecting four ducts.

More than one million sq ft of manufacturing area will be devoted to the jet transport. This includes installation of more than $3,220,000 worth of heavy machine tools required to fabricate the specialized, high-strength components which go into the aircraft.



Three-view of the swept-wing 880, now in production at San Diego Plant 1 of Convair Division of General Dynamics Corp.

CONDENSED SPECIFICATIONS OF THE CONVAIR 880

Cruising Speed	615 mph	Passengers	109 or 88	Wing Span	120 ft	Engines	Four GE-805-3 jet engines equipped with silencers and thrust reversers
Cruising Alt.	40,000 ft	Payload	23,150 lb	Wing Area	2000 sq ft		
Rate of Climb	3600 fpm	Fuel	10,800 gal	Length	129 ft, 4 in.		
Stalling Speed	115 mph	Oil	28 gal	Height	36 ft		
Range	3250 miles	Cargo	983 cu ft	Weight	82,100 lb		

Air Spring Assembly at Cadillac

Air Spring Components Tested and Installed, and Grilles Fabricated at Cadillac Division of General Motors

DURING the course of a press conference held recently at the Cadillac Division, the method of assembling the unique aluminum grille and the testing and installation of the air ride system were among the interesting activities. Suitable illustrations taken at selected points will pinpoint the places of particular interest.

The Cadillac grille, as illustrated, consists of six horizontal fins, with 27 short vertical fins and 80 grille ornaments. While the latter present an ornamental appearance when viewing the car from the front, they serve a very utilitarian function of tying the grille assembly into a strong, integral structure.

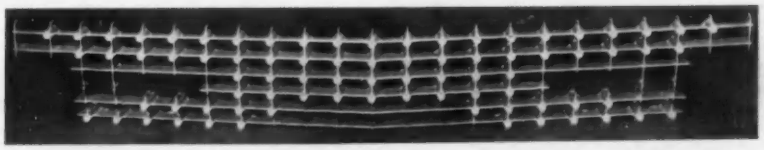
Several illustrations show major steps in the assembly of this grille. The first step on the merry-go-round conveyor is to place the six horizontal fins in the fixture, then space them and tie them together by means of the 27 vertical fins. The fixture then is turned to a vertical position to facilitate installation of the 80 grille ornaments. These serve to produce a secure joint at each junction of the horizontal fin and vertical fin. These operations are completed at succeeding stations along the line and as the fixtures move to the opposite side of the conveyor, each ornament is fitted with a rubber insulator, prior to insertion into the grille fin assembly, then locked in place by means of a vibration-resisting lock washer.

At the end of the line the integral grille assembly is removed from the fixture and placed on a belt conveyor for feeding to the adjacent front bumper assembly

Start of grille assembly on the merry-go-round assembly conveyor. The operator in the foreground is seen in the act of placing horizontal and vertical strips in the fixture.

On the side opposite starting stations of the merry-go-round conveyor—grille assemblies have been locked in the fixture and the operators are completing the installation of the 80 grille ornaments.

By
Joseph
Geschelin



The 1958 Cadillac grille assembly in the form in which it is installed in the front bumper assembly.

ASSEMBLING THE GRILLE

line. Meanwhile, front bumper assemblies are being prepared on another merry-go-round line, illustrated here. Initial operations on the bumper assembly are handled on one side of this line, then the grille is installed when the fixtures reach the opposite side.

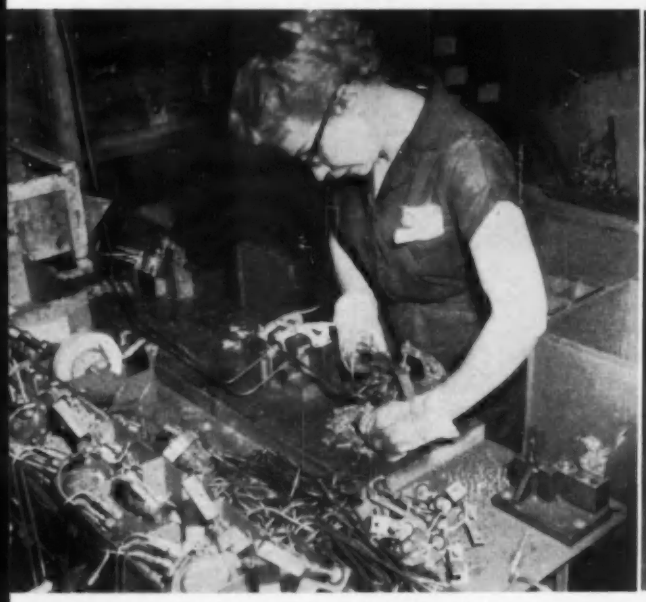
At this point the operators also install the bumper lamp assemblies —either fog lamps or parking lamps as specified, and tighten all fastenings. At the end of the line the front bumper assembly, complete in all details, is removed from the fixture and placed on a monorail conveyor for transport to the final car assembly line.

Since the use of air ride is new this year, in most plants except at Cadillac, it may be of interest to note the procedure employed here. For one thing, it is noteworthy that no distinction is made between the chassis for air ride and those of conventional coil spring suspension. They all go over the same lines at random—according to a definite schedule, of course.

Initial steps in the installation of air ride components take place at the very inception of the suspended chassis frame assembly as the frames move along on a monorail conveyor. At this point the air cushions are installed in place and the plumbing harness is loosely attached. As the conveyor moves along this line, the plumbing attachments are made secure, the air cushions are inflated with shop air at a pressure of 40 psi. At this stage an operator sprays a water-soap solution onto certain critical joints to observe tightness at all such points. Then the fittings at the domes are loosened to permit

Near the end of the grille assembly line. This operator is driving the lockwasher over the rubber grommet in each of the 80 ornaments for secure attachment. At the end of this line the integral grille assembly goes to the front bumper assembly line.

Close-up of one of the stations on the front bumper merry-go-round assembly conveyor. The grille has been attached in place and the operator is installing the parking lamp and bumper attachment bracket.



Start of air ride assembly. This is one of a number of stations at which the plumbing harness and fitting assembly are prepared.

Start of the chassis frame assembly line. While the frame rides suspended on the monorail conveyor operators install the air cushions on designated frames.

INSTALLATION OF AIR SPRINGS

Above, left—At this point on the suspended frame line, the plumbing harness has been installed and fittings and attachments made up. Above, right—Just before the frames leave the frame area on their way to final assembly, the bellows are inflated and all joints sprayed with a water-soap solution to detect leaks. The fittings at the bellows then are loosened to bleed out the air while en route to the final assembly line.

the air to escape during the trip to the final assembly line.

At the start of final car assembly, the procedure is conventional, with running gear units installed while the chassis is up-side-down on the flat conveyor. Since the air cushions are deflated at this point, spacer blocks are placed under each side of the rear axle housing and front suspension arms to effect a standard height location, thus providing a standard height platform while the front and rear leveling valves are attached and adjusted.

Further along the line, after the body drop and installation of the radiator assembly and air reservoir, the air reservoir is inflated to a pressure of 250 psi. Through the medium of a regulating valve, however, the operating system works at 125 psi. Since the system is open to the atmosphere and since no air is added by the air compressor, the air in the system is constantly exhausted as additional components are added to the assembly. In fact, air is exhausted every time an operator gets in and out of the car or applies pressure to the structure.

Because of this, air is added to the system at various points along the assembly line, right up to the point where the engine is started and the air compressor gets into action.

Preceding these assembly operations the air cushions are given 100 per cent inspection in special test equipment, before they are accepted for installation on the car assembly line. This is a precisely controlled differential leak test in which the pressure within the cushion is maintained at 150 psi. The amount of acceptable leakage rate is 1 psi drop in 24 hours, maximum, checked in a matter of less than a minute in this accelerated test.

The testing machines, developed and built by the Process Development section of General Motors, are arranged to open the test fixture when the air cushion checks within the specified limits. If the part fails to meet the test, the machine turns on a red warning light, making it necessary for the operator to release the cushion manually and set it aside as a reject.

Although the procedure is quite involved all along the line, it has paid off at Cadillac since they have been free from customer complaints in the field.

• • •

Chrysler and Willys Call Off Brazilian Manufacturing Plan

Chrysler Corp. and Willys have cancelled plans for manufacturing the Plymouth passenger car in Brazil. Under terms of the manufacturing agreement, Plymouth Savoys would have been built in Sao Paulo by Willy-Overland do Brasil, subsidiary of Willys-Overland Export Corp.

The future of a similar arrangement in Argentina is left in doubt by the Brazilian cancellation, and Chrysler may find itself without an export passenger car in South America. Chrysler did not meet a Brazilian government deadline to submit a manufacturing plan of its own for that country.

Meanwhile, the Willys subsidiaries in Brazil and Argentina are proceeding with expansion program of their own.

In Sao Paulo, the Willys plant is boosting Jeep production from 9000 in 1957 to a current rate of 15,000 annually. A new engine plant, constructed just last year, is supplying all of the company's engine requirements. The engine plant already is being expanded.

A new body stamping division will begin operations next summer.

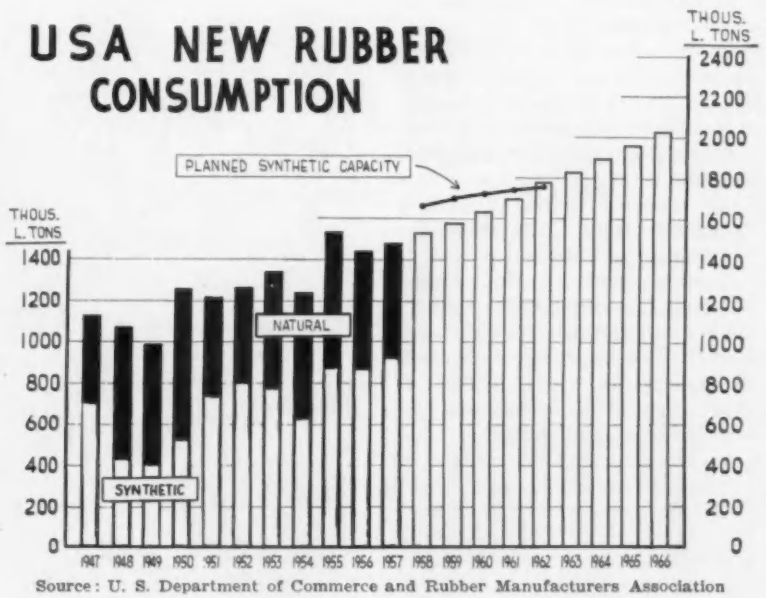
The Willys subsidiary in Argentina, Industrias Kaiser, expects to be in production this month (April) on a modified version of the 1955 Kaiser Manhattan. Volume production is expected in June.

The plant at Cordoba already is producing at the rate of 1500 Jeep vehicles a month and hopes to boost this to 2500 units monthly by the end of 1958.

The Argentine company is owned 31 per cent by Willys, 20 per cent by the Argentine government and the balance by some 10,000 native shareholders.

Industrias Kaiser expects its national content—that is, the amount of parts made within the country—to reach 90 per cent by the end of this year.

In Brazil the national content of Jeep vehicles is approaching that. The Brazilian government requires that the figure reach 95 per cent by June 30, 1960.



Source: U. S. Department of Commerce and Rubber Manufacturers Association

POWDER METALLURGY

Scores Impressive Gains

By
Andrew W. Shearer

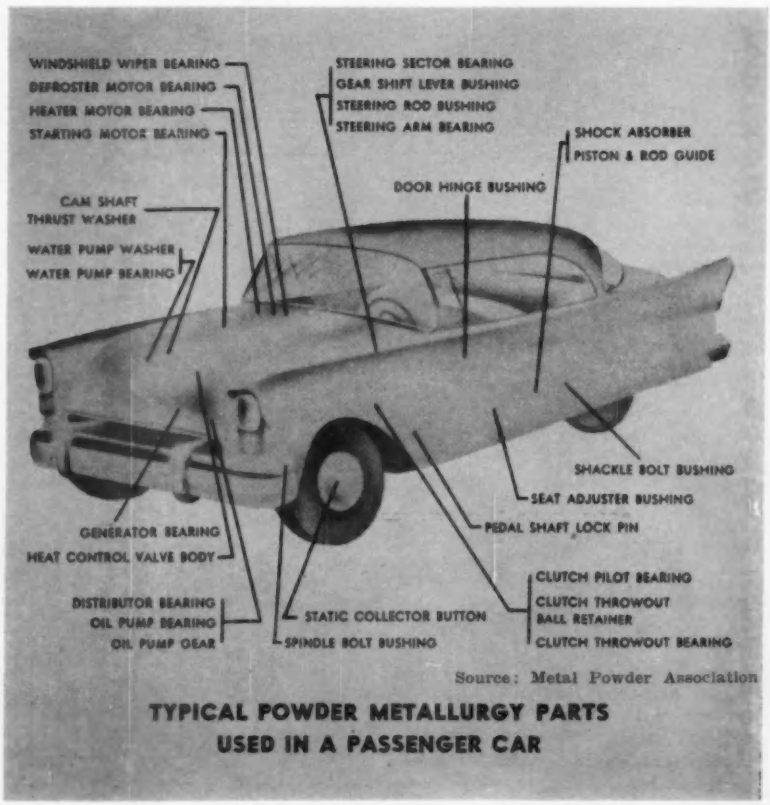
Unique Properties of Parts Made by Process Provide Wide Range Of Cost-Cutting Possibilities in Automotive and Other Fields

WHILE applications for powder metallurgy parts in other fields continue to grow at a rapid pace, the automobile industry still represents their largest single market. The average passenger car contains more than 100 parts made by the process, such as self-lubricating bearings, timing gears, oil pump gears, door cams and latches, contact points, fuel line filters, clutch facings, etc.

Many hundreds of other similar parts are used in trucks, buses, tractors, off-highway equipment, and gasoline and Diesel engines. Current automotive consumption of metal powders probably runs in the neighborhood of 50 million lb annually.

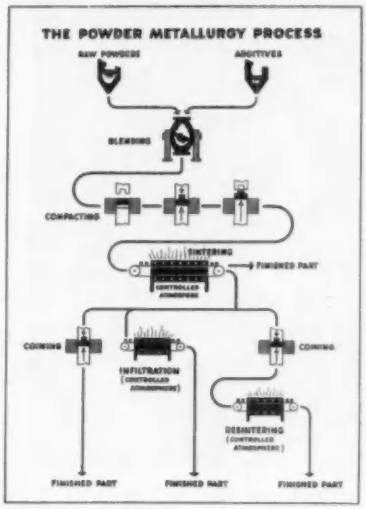
An extensive listing of modern automotive applications of powder metallurgy parts was contained in a paper presented by Joseph Geschelin, Detroit Editor of AUTOMOTIVE INDUSTRIES, at the Tenth Annual Meeting of the Metal Powder Association (see AI, May 15, 1954). Typical major uses are pinpointed in the phantom car diagram included with this article.

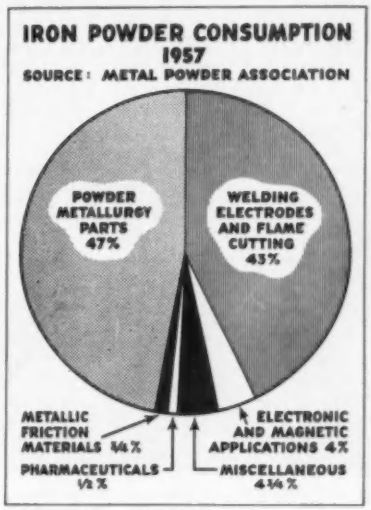
The reasons why powder metallurgy has assumed a role of such far-reaching and ever-growing proportions in the automobile industry are manifold. Parts can be made with the process to exact dimensions within close tolerances by molding the powders and controlling the shape of the compacts during sintering (heating in a controlled atmosphere). Intricate

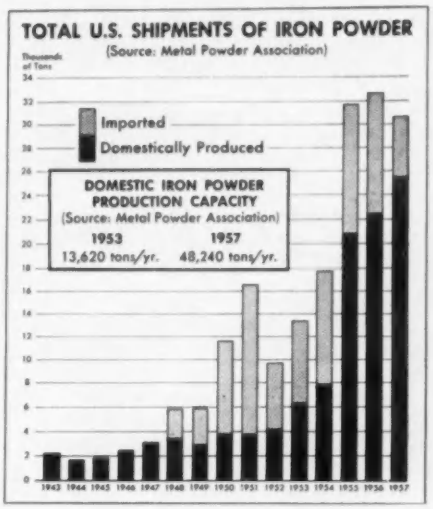


Source: Metal Powder Association

TYPICAL POWDER METALLURGY PARTS USED IN A PASSENGER CAR







shapes can be obtained with little or no costly and time-consuming machining, and scrap losses are just about eliminated. The process has proved to be the most practical and economical method for producing many parts with splines, gear teeth, eccentric bores, and holes or depressions of varied shapes.

The economics of powder metallurgy parts that can replace machined parts warrant special mention. Tooling for a powder metallurgy part takes only a matter of weeks in many cases, compared with the months often required for an ordinary machined part.

These considerations have prompted many of the larger automotive concerns to conduct extensive programs of studying potential applications for powder metallurgy parts. Some manufacturers have staff metallurgists who devote their time exclusively to this work. One of the Big Three automobile companies has its own metal powder department and produces a percentage of powder metallurgy parts for its own consumption. The sizable untapped potential which still remains for such parts in automotive applications offers many broadened design possibilities as well as manufacturing economies.

Growth of Powder Metallurgy

The history of the development of powder metallurgy is as fascinating as its growth has been explosive. The process finds its origins in antiquity when it was first used by our ancestors to fashion tools and weapons. Up until about the middle of the 19th century, however, the art was a somewhat neglected one. The process did not undergo a true revival from the viewpoint of present-day applications until early in this century, when it was used as a means of making self-lubricating bearings. Since that time the growth of the powder metallurgy industry has been nothing short of phenomenal.

As shown on the accompanying chart, total U. S. shipments of iron powder ("bellwether" of the powder metallurgy industry) soared from a scant 2000 tons or so in 1943 to a whopping total of 32,625 tons in 1956. While total 1957 iron powder consumption of 30,525 tons was some six per cent below that for the preceding year, the drop was significantly less than the approximate 7½ to 8 per cent reduction in general industrial activity.

The trend toward increased independence from foreign sources of supply continued during 1957. In 1956, about 22,500 tons of iron powder were produced domestically, while nearly 10,000 tons were imported. But, in 1957, domestic production increased to almost 25,400 tons, and imports declined to about 5000 tons. A recent survey by the Metal Powder Association disclosed that present production capacity of iron powders in the U. S. and Canada alone is more than 48,000 tons per year.

Consumption of nonferrous metal powders — principally flake and granular brass, bronze and copper —showed a similar pattern to that of iron powder. According to U. S. Dept. of Commerce figures, 18,000 tons of copper base powders were consumed in 1957. This represents a drop of 1000 tons from the 1956 total.

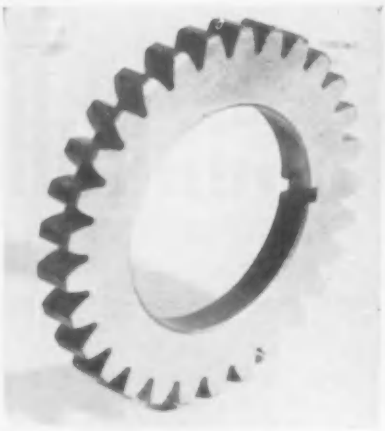
In addition to the two main categories of metal powders—iron and copper base — fair quantities of special metal powders, such as those of stainless steel and nickel alloys, are produced for structural parts.

Widespread Applications

Applications for iron powder are primarily industrial, as can be seen from the "pie" diagram. About 47 per cent of the iron powder pro-

Typical self-lubricating bearings used in Chrysler Corp. cars (Photo courtesy of Amplex Div., Chrysler Corp.)

Pressing of metal powders into self-lubricating bearings. "Green" compacts are shown prior to the sintering process.



This is an oil-impregnated sintered iron gear used in the transmission oil pump drive mechanism of a Ford passenger car. It measures about three in. across with a 1¾ in. I.D. By switching to an iron powder gear, Ford succeeded in eliminating a screw machine and hobbing operation on alloy steel bar stock.

duced in 1957 was used to make structural parts, such as gears, cams, bearings, and the like. Another 43 per cent went into the making of coated welding electrodes and powders for flame cutting of metals. An important ¾ of 1 per cent was used to make metallic friction materials, such as brake linings. An even smaller percentage was used by the pharmaceutical industry for iron-enriched products. Even in the "miscellaneous" category, which accounted for the remaining 4¾ per cent, much of the use was industrial.

Running a close second to the automobile industry as a major market for powder metallurgy parts is the appliance field. Dishwashers, air conditioners, washing machines, and other equipment are utilizing more structural powder metallurgy parts each year.

The hardware industry is also a major consumer of such parts in the form of padlocks, bearings, cams, and many other shapes and forms. Powder metallurgy parts are employed in all of these products to provide an unexcelled combination of close dimensional tolerances and good surface finish at low cost.

Aircraft applications for powder metallurgy parts continue to increase. A prime factor is the development of the SAP (sintered aluminum powder) aluminum powder metallurgy process, which produces parts that are said to maintain strength at much higher operating temperatures than conventional aluminum parts. Rockets and missiles are also making use of powder metallurgy in such parts as fuel elements and filter media.

Technological Advances

There are many reasons why powder metallurgy has made such giant strides in the past 50 years or so. The continuous extensive research and development programs carried on by the industry and the availability of purer and more uniform powdered materials at lower cost have been important contributing factors. In addition, closer control of processing, refined manufacturing techniques, and more powerful and versatile presses have enabled the production of denser parts with superior physical characteritsics.

Presses used in the past for production of powder metallurgy parts were often mere modifications of ordinary tableting units. In recent years, however, manufacturers have steadily developed presses of ever-increasing capacities with more complex equipment for producing more intricately shaped and larger parts. There has also been a trend on the part of the fabricators themselves to modify standard presses to their own particular requirements. Extensive improvements have also been made by the builders of sintering furnaces.

The better latitude now available in both tools and presses has shattered to a large extent a former sizable barrier in the path of expanded applications for powder metallurgy—the size of parts which could be produced. Using modern equipment, parts so tiny that 10,000 weigh only one pound, and others of 20 in. diam and weighing 250 lb each — or more — can be turned out. The cost savings, plus closer control over dimensions and properties, which can be thus attained are formidable.

(*Turn to page* 116, *please*)

. . . . . Trends in the CONSTRUCTION EQUIPMENT INDUSTRY

By
Kenneth Rose

THE Associated General Contractors, at their meeting in Dallas recently, heard the prediction that construction in 1958 would be about $3 billion above the 1957 level of approximately $65 billion, but that at least part of this increase would represent inflation and higher prices rather than increase in volume of work done. Building construction, which requires less equipment than highway and similar earthmoving operations, is expected to increase about five per cent. A substantial backlog of public works projects now exists, said the heavy construction division of the AGC, and Federal contract financing is expected to come to the end of its 1957 difficulties.

Right of Way Costs

Apathy upon the part of the public toward right-of-way costs may make the Federal-aid highway program unreasonably costly, Claude R. McMillan, chief commissioner of South Carolina Highway Department, warned the convention. This was a prime factor in re-evaluating the program, which is now expected to exceed original estimates by more than one-third, he said. He foresaw that about five years would be added to the time estimate, bringing the total to about 20 years, and that additions to the program sought by the association of state highway officials might extend this even farther. The program would be expensive, he warned, and in some states the public might be over-optimistic about the ability of their highway departments to finance the programs.

Increased Number of Contracts Wanted

A five per cent increase in the number of contracts awarded would be of more value to the contractors than a five per cent increase in the dollar volume of construction with fewer contracts, Hal C. Dyer stated. The volume of work done by at least 80 per cent of the contractors consists of several jobs that run less than a million dollars, he said. He warned against competitive practices that are causing the business to become more hazardous financially. "During the past 12 consecutive years the volume of construction work has increased, and the number of failures among the people who make up our industry has increased at an even greater pace. One does not need an expert to tell him the profits realized are dangerously out of proportion to the risk the builder must take, and certainly out of line with the capital required properly to carry on a contracting business," he said. "Of those who have escaped bankruptcy," he said, "an even greater number have failed to show much gain, if any, in their working capital."

Depreciation for Tax Purposes

The association heard Travis Brown, of the legal firm of Hayes and Hayes, explain some of the problems of depreciation and salvage value of equipment for tax purposes. The basic test under the new regulations is the contractor's particular experience with his own equipment. It is extremely difficult for contractors to recover their capital and buy replacements under long life and low depreciation rates now insisted upon by Internal Revenue. Present depreciable lives were set up during depression years, when industry was not able to replace equipment on a normal schedule. Many foreign countries, such as Canada, France, Japan, Germany, Sweden, and Great Britain, have an optional maximum rate for depreciation, or permit revaluation to permit depreciation on a more or less replacement cost basis. Machine tools, for example, that must be depreciated over a 15-to-33 year period in the United States, can be depreciated in 10 years or less in many of these other countries. Only by acquiring and maintaining the most efficient construction equipment available, he said, can contractors keep bid prices low and perform their work in the best interests of the public.

Federal Aid Highway Program

With demands that the time for completion of the Federal-aid highway program be lengthened to 20 or 22 years, or maintained on the 13 year schedule, or shortened to 8 years, and that the funds be allocated to pay many administration costs for other departments, or conserved, or that they be increased by about $900 millions for the next several fiscal years, the exact status of the program is in doubt. It seems likely that there will be some additional funds provided so that the yearly allocations, to have been curtailed sharply over the next several years because of depletion of the trust fund more rapidly than expected, will be restored to approximately the $2.2 billions per year originally planned. (*Turn to page* 142, *please*)

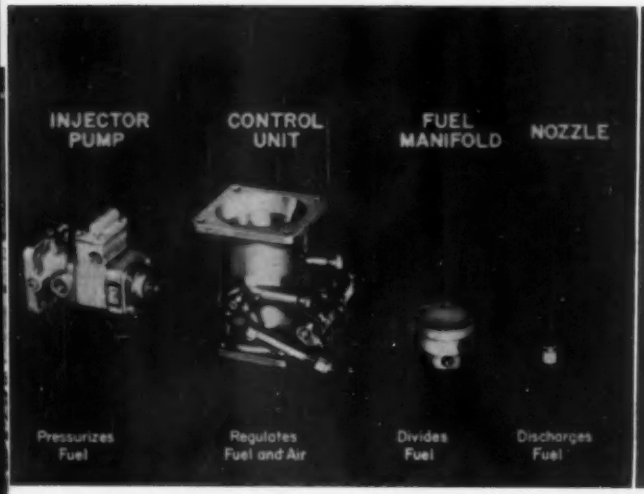


FIG. 1—Four basic elements of the system

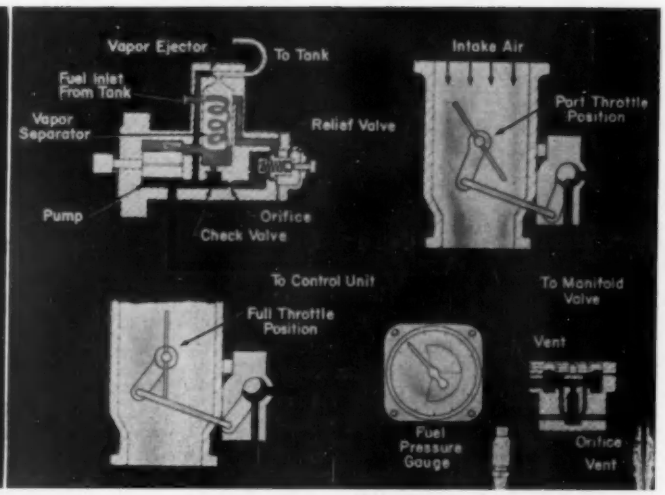


FIG. 2—Schematic fuel flow diagram

Continental's Fuel Injection

By
Wm. A. Wiseman
Chief Engineer
and Director of Quality
CONTINENTAL MOTORS CORP.
Aircraft Engine Div.
MUSKEGON, MICH.

THE Continental Motors fuel injection system for business aircraft is a simple, low pressure system of injecting fuel into the intake valve port in the cylinder head. It is designed for ready adaptation to engines of widely varying power ratings, displacement, and number of cylinders.

FIG. 1

There are four basic elements in the system as shown in Fig. 1: the injector pump which pressurizes the fuel; the control unit which regulates fuel and air; the manifold valve which divides the fuel; and the nozzles which discharge the fuel.

FIG. 2

Briefly, the function of each component is illustrated by means of the schematic fuel flow diagram. The fuel injection pump is shown in the upper left hand corner of the diagram in Fig. 2. Fuel enters the system at the swirl well of the vapor separator. Here vapor is separated by a swirling motion so that only liquid fuel is fed to the pump from the bottom of the well. The vapor is drawn from the top center of the swirl well by a small pressure-jet of fuel and is fed into the vapor return line. This line carries the vapor back to the fuel tank.

There are no moving parts in the vapor separator. Solid fuel enters the rotating vanes of the pump and is pressurized. Part of this fuel goes to a fixed orifice and

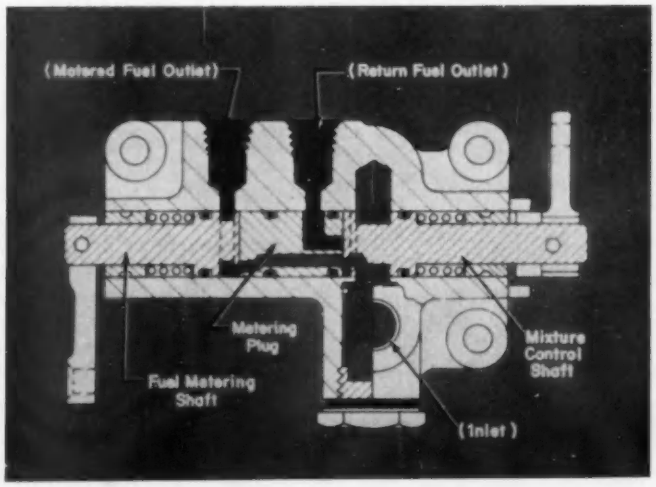


FIG. 5—Fuel-air control unit

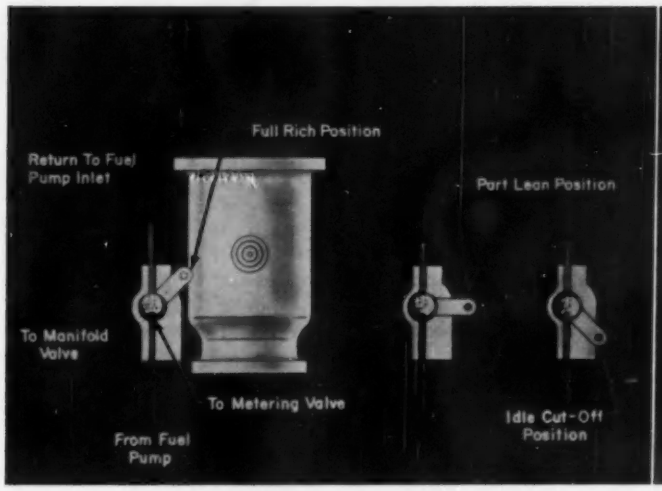


FIG. 3—Mixture control valve

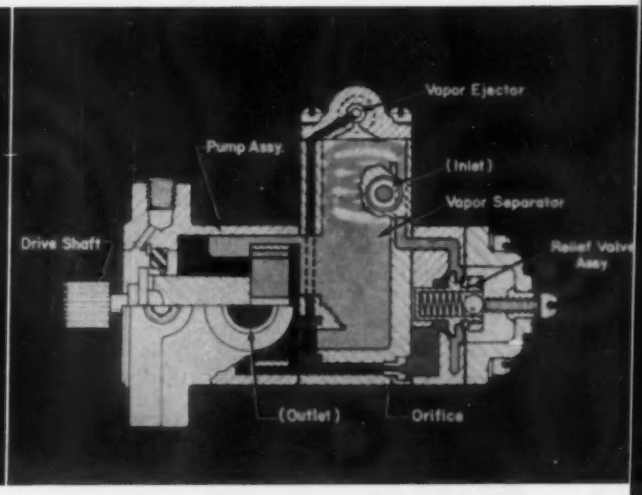


FIG. 4—Sectional view of fuel pump

for Business Aircraft

part goes to a variable orifice in the control unit. The relief valve is used only to maintain minimum pressure at idle speed.

A check valve is provided so that boost pressure to the system can by-pass the engine-driven pump in starting. This feature is also available to suppress vapor formation under high ambient temperatures of the fuel. Further, this permits use of the auxiliary pump as a source of fuel pressure in the unlikely event of failure of the engine-driven pump.

The fuel-air control unit is shown in the upper right hand corner of Fig. 2. The function of this assembly is to control the engine air intake and to set the metered fuel pressure for proper fuel/air ratio. The air throttle is mounted at the manifold inlet and its butterfly valve controls the flow of air to the engine as positioned by the throttle control in the aircraft.

Pressurized fuel enters the control unit through a strainer and passes to the metering valve. This rotary valve has a cam-shaped edge across the fuel delivery port, and the position of the cam at the port controls the fuel passed to the manifold valve and the nozzles. By connecting the metering

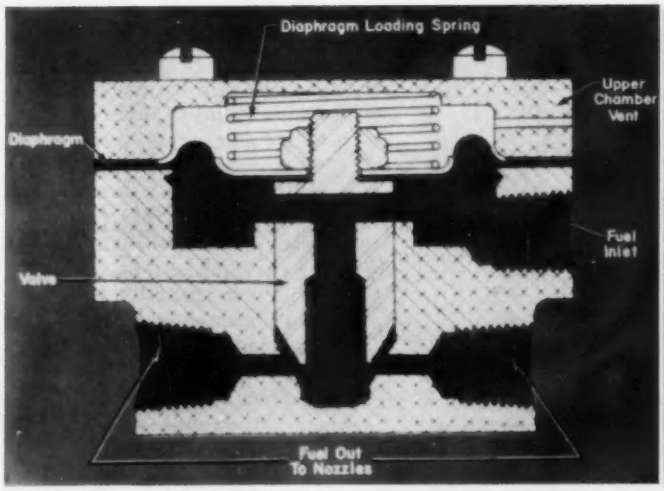


FIG. 6—Fuel manifold valve assembly

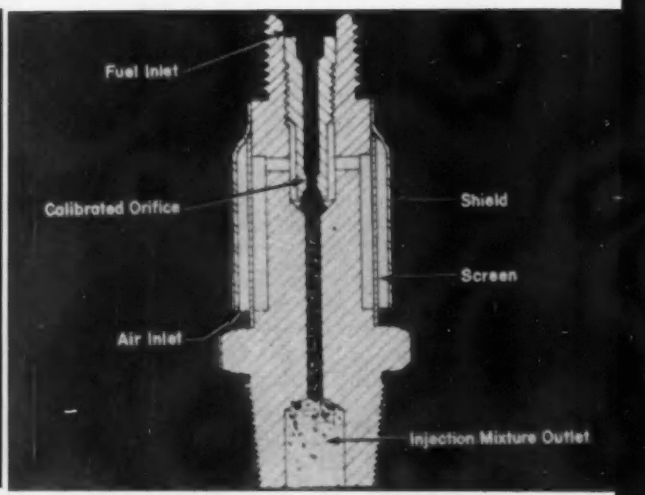


FIG. 7—Details of the fuel discharge nozzle

valve to the air throttle the fuel flow is then properly proportioned to air flow for the correct fuel-air ratio. The lower left hand view shows the butterfly valve and the metering unit in the full throttle position, allowing full air flow and full fuel flow to the manifold valve.

The fuel manifold valve is shown in the lower right hand corner of Fig. 2. From the fuel injection control valve, fuel is delivered to the fuel manifold valve which provides a central point for dividing fuel under equal pressure to the individual cylinders. In the fuel manifold valve a diaphragm and plunger valve raises, by fuel pressure, to open the individual cylinder fuel supply ports simultaneously. A ball check valve under the plunger serves to insure that the plunger fully opens the outlet ports before fuel flow starts. There is no restriction to flow in the fuel manifold valve. A fine mesh screen is included as additional protection of the injection nozzles against dirt or foreign matter.

Fuel injection nozzles are connected to the manifold valve. Individual fuel lines carry the metered fuel to the fuel discharge nozzles, one for each cylinder. These are installed in the cylinder heads outside each intake valve. While a calibrated orifice is used there is no valve and no structure of closely-fitted moving parts to be sensitive to dirt or icing. In fact there are *no* moving parts.

An air bleed arrangement is incorporated in each nozzle. This aids in atomization of fuel, and by breaking the high vacuum at idle maintains the fuel lines solidly filled and ready for instant acceleration of the engine.

Thus, the four main components covered, together with fuel lines suitable for the installation, form the complete system as furnished by Continental Motors. Cooling shrouds are also provided and installed as protection for the fuel against high nacelle temperatures.

FIG. 3

Mixture control operation is accomplished by a positive linkage to a cam-and-double port valve (Fig. 3), which reduces the fuel pressure applied to the metering valve by spilling the fuel and allowing it to by-pass back to the pump. It permits the operator to lean the mixture for most economical power at any operating point.

Provisions are made for a gage to read metered fuel pressure. This gage permits simple and accurate adjustment of the mixture for any altitude and power within engine ratings.

When the mixture control valve is placed in idle cut-off position (full lean) the fuel supply to the system is simultaneously by-passed back to the inlet side of the fuel pump, and flow is cut off to the metering valve. Thus with zero pressure the fuel manifold valve closes the line to each nozzle so that the complete system remains primed for easy starting.

FIG. 4

The fuel pump, Fig. 4, is a positive-displacement, rotary vane design. It has a splined shaft for connection to the accessory drive system of the engine. A spring-loaded, diaphragm - type relief valve is provided, and the previously described orifice is installed in the fuel passage to this relief valve. The relief valve diaphragm chamber is vented to atmosphere. A spring - loaded, disk type check valve is installed which permits positive feed pressure to by-pass the engine-driven pump. The vapor separator is a die casting incorporating the swirl well and passages to the relief valve, the by-pass check valve, and the vapor augmenting jet. The latter is installed in the cover of the vapor separator.

FIG. 5

The fuel-air control unit, shown in Fig. 5, occupies the position ordinarily used for the carburetor at the intake manifold inlet. There are three control elements in this unit, one for air in the air throttle assembly and two for fuel in the fuel control assembly which is mounted on the side of the air throttle assembly. The air throttle assembly is an aluminum casting which contains the shaft and butterfly - valve assembly. The casting bore size is tailored to the engine size and no venturi or other restriction is used. Wave washers provide protection against vibration. The conventional idle speed adjusting screw is provided in the air throttle shaft lever and bears against a stop pin in the casting. The fuel control body is made of bronze for best bearing action with the stainless steel valves. Its central bore contains a metering valve at one end and a mixture control valve at the other end. These rotary valves are carried in oil-impregnated bushings, and are sealed against leakage by O-rings. Loading springs force the valve ends against a fixed plug installed in the middle of the central bore. This bronze plug has one passage that mates with the fuel return port and one through passage that connects the mixture control valve chamber with the metering valve chamber. O-rings seal this plug in the body. Each stainless steel rotary valve includes a groove which forms a fuel chamber. A contoured end face of the mixture control valve aligns with the passages in the metering plug to regulate the fuel flow from the fuel chamber. A control lever is mounted on the mixture control valve shaft for connection to the cockpit mixture control. A control lever, mounted on the metering valve shaft, connects to the linkage to the air throttle.

A fuel return port in the bronze body connects to the return passage of the center plug, and registration of the mixture control valve with this passage determines the amount of fuel returned to the fuel pump.

FIG. 6

Contained in the fuel manifold valve body are a fuel inlet, a diaphragm chamber, and outlet ports for the lines to the individual nozzles, as illustrated in Fig. 6. The spring-loaded diaphragm carries a plunger in the central bore of the body. When the plunger is down against the lapped seat in the body the fuel lines to the cylinders are closed off. The plunger is

(*Turn to page* 154, *please*)

Leyland Bus Has Independent Front Suspension *with* Bonded Rubber Springing

LEYLAND (British) buses for the Netherland Railways, with bodies and underframes built in Holland by Verheul, use independent front suspension employing lower links carried on splined tubes rubber-bonded to the fabricated beam. Upper links pivot on rubber bushings at both ends. Other design features include air brakes with independent systems for front and rear; a non-reflecting elliptical windshield that permits bright interior lighting; and electro-pneumatically operated doors that open outwards to lie flat against the body outer panels. The mid-mounted Underfloor Diesel develops 130 hp, and drive is through a Leyland Pneumo-Cyclic gearbox.

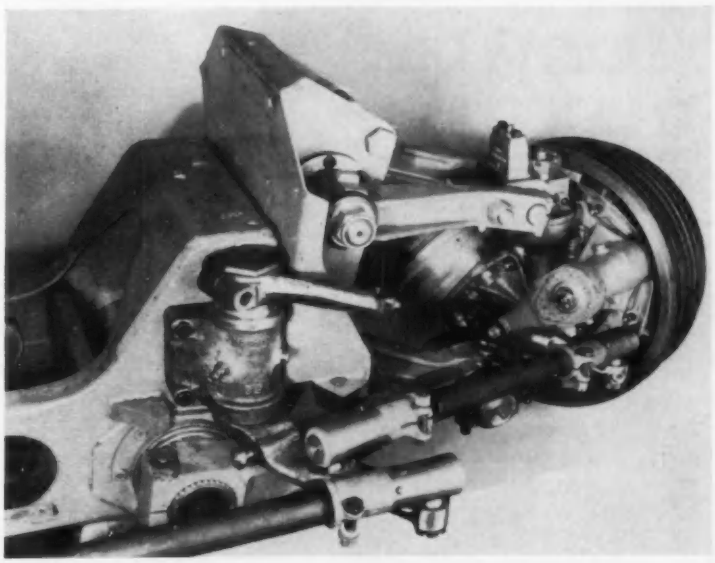
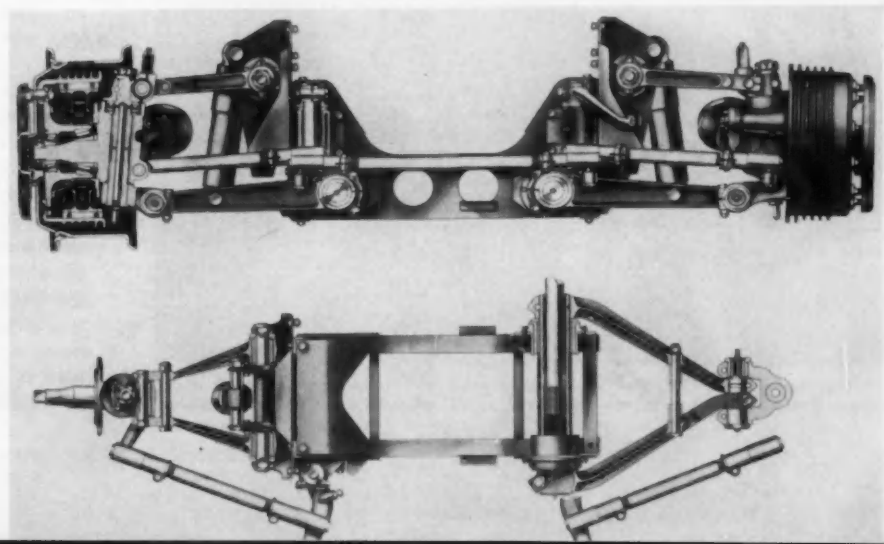


Illustration at right shows overall view of right front suspension unit

Part-cutaway of the complete front suspension unit is shown in upper portion of illustration at right.



Overhead view in lower illustration, shows details of the upper suspension arm, with shaft and bushings at left; lower suspension arm, shaft and splined tubes rubber bonded to the fabricated beam at right

Many of the Machines in British Plant Are American, or Are Manufactured in Britain by U. S. Subsidiaries or Under License

New Body Plant

By David Scott

THE $100 million expansion program of General Motors' Vauxhall plant in Britain, announced in 1954, is now virtually completed. Its aim was to almost double production, the target for 1958 being a total of 250,000 cars and trucks. The two main factories have been greatly enlarged, with passenger car manufacture concentrated at the main plant at Luton, and trucks at the smaller one at Dunstable, six miles away.

Total payroll has been increased to over 20,000, while nearly 2000 new machines have been installed and 7500 existing ones relocated. Much of the new equipment is American, or built in Britain by U. S. subsidiaries or under license.

Major project of the program is an entirely new building at Luton that houses the car press shop, body welding, painting, trimming and final assembly. All production and assembly lines are tooled to handle both the four-cylinder Victor and the six-cylinder Velox/Cresta. With four levels providing a total floor area of 1.5 million square feet, this L-shaped block is believed to be one of the most modern plants of its kind in Europe.

The press shop on the ground floor covers one entire end of the building, where over 200 machines are ranged in two dozen parallel lines across the full width of 900 ft. More than half of these are British Clearings, made in England by Vickers-Armstrongs, and 114 of them are bottom-drive.

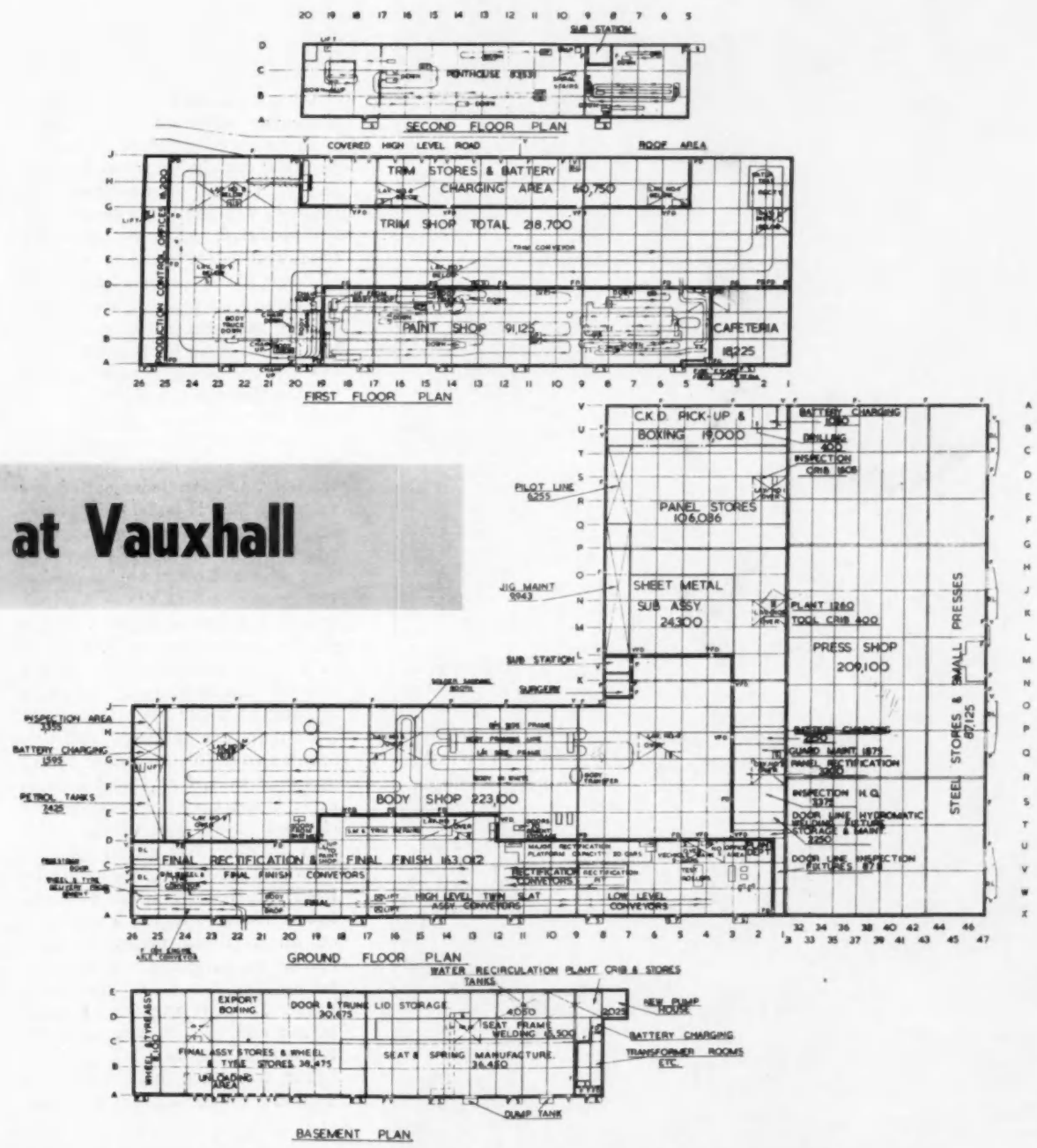
Most of the 122 British Clearing presses used by Vauxhall are bottom drive units. Scrap conveyors in the basement carry off-cuts directly to the baler.

The main floor of this area is a lattice of steel I-beams, bolted together and supported by concrete pillars, whose positions can be readily varied to accommodate the presses in any desired locations. Off-cuts from each press drop straight through the floor onto one of the nine feeder conveyors in the basement. These tributaries pour their burden onto the central main belt leading to the Lindemann scrap baler. Rectangular blocks weighing up to 500 lb are then conveyed through an underground tunnel and up into an adjacent small building where they are loaded by magnetic hoist onto waiting trucks.

Stocks of steel in both precut sheets and coils are stored at the end of the floor before the press lines, where coils are fed and washed by McKay automatic equipment, then blanked on British Clearing machines. Vauxhall-built work-handling devices are prominent on the various press lines, typical of which is that for door inner panels, made up entirely of British Clearings.

Blanks are placed manually on

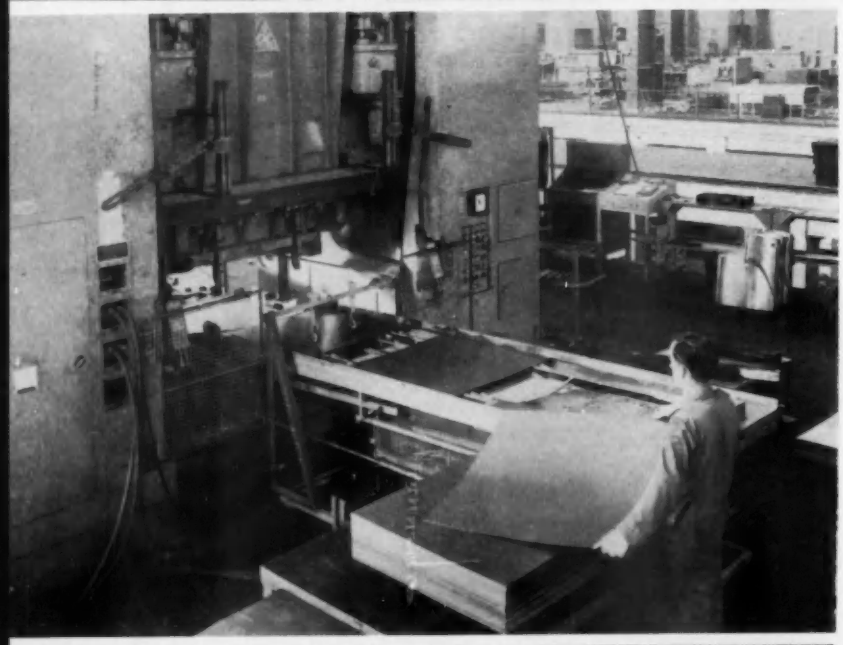
at Vauxhall

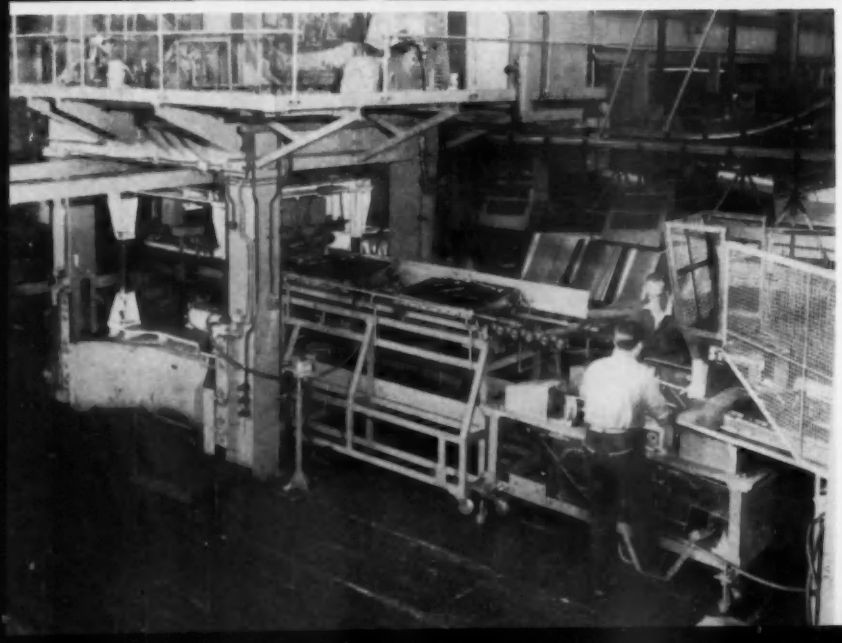


Floor plan of the new four-level block housing the press shop, welding, painting, and final assembly.

the automatic shuttle loader that shoots them singly between the open dies of the first 500/300-ton double-action press for the initial draw. The downward stroke is triggered off by the arriving blank, after which the rough stamping is ejected from the lower die by mechanical lifters. An iron hand then extracts it and drops it vertically into an air-operated turn-over mechanism that tosses it upside down along guide rails onto a belt conveyor leading to the second press. The following five single-action presses are all linked by extractors and conveyors.

A parallel line of four presses simultaneously forms the simpler door outer panels. Completed stampings are conveyed away on an endless overhead chain to a remote spray booth where sound deadening compound is applied to their inner surfaces. After returning to the terminal point of the two lines, they are permanently mated with the inner panels on three welding and flanging presses. (*Continued on next page*)





These two lines make the four doors for both cars, requiring a total of 16 complete sets of dies. Vauxhall usually has a two-day run for each type of door, and in these 40 working hours about 7000 are produced. In order to insure uninterrupted production, a stock of some 35,000 doors of all kinds are carried on a storage conveyor in the basement directly beneath the body shop. From there they are drawn off as needed, when window frames are added on the main floor above.

Press lines for other components have their logical places on the floor, and terminate at the appropriate sheet metal sub-assembly areas. For instance, the rear wheel arch, fender, tail fin, gas filler door and other pressings converage on one spot where they are welded together as a unit. Rear-quarter assemblies are hooked onto a chain conveyor that snakes through the building to the main welding lines for body sides.

Other prefabricated sections, such as door frames, center pillars and roof rails, flow into the same area. There they are progressively clamped in the jigs of the body-side welding line. Two parallel lines are used (right- and left-hand), and each consists of 28 fixture frames suspended vertically on an overhead monorail that moves continuously during the build-up of the sides. The same fixtures, with variable location points and clamps, are employed for both car models.

The two lines flank a straight section of the oval-shaped main

Top—
Coil steel is initially handled by McKay equipment, then blanked on British Clearing presses made by Vickers-Armstrong.

Middle—
Automatic shuttle loader feeds the first double-action press on one of the door lines.

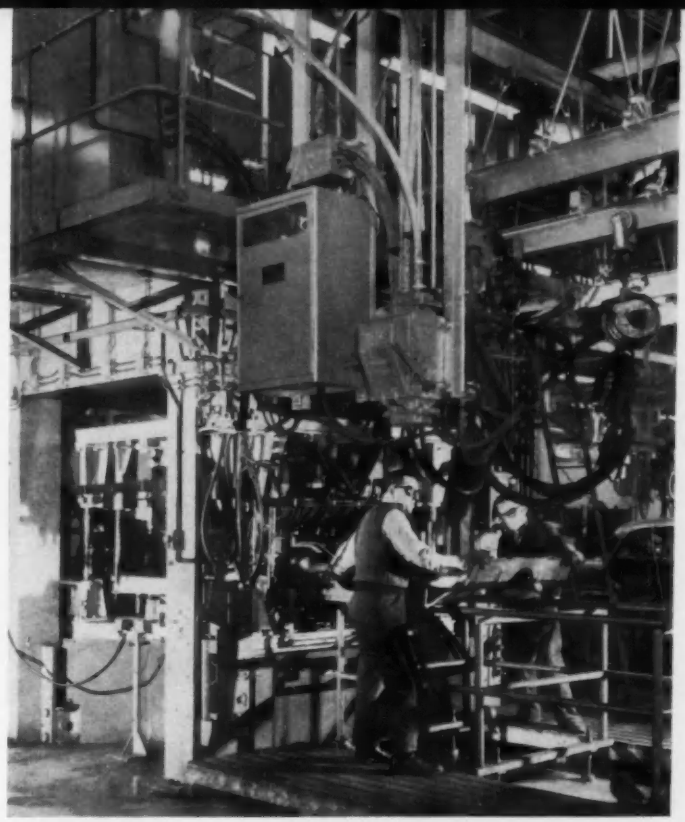
Bottom—
Inner and outer door panels are mated on a group of welding and flanging presses that follows the two press lines.

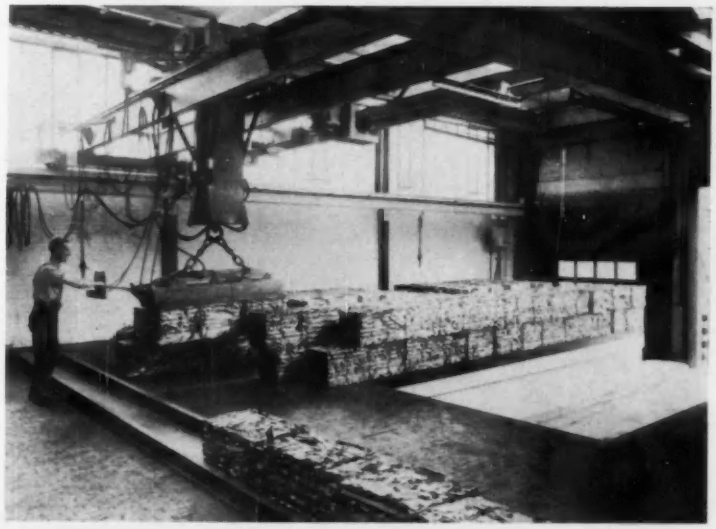
welding circuit, whose 42 truck-mounted jigs, creeping forward in the opposite direction, have meanwhile been accumulating pressings for the unitized underbody. At the end of their lines, each pair of opposed side jigs moves onto transfer sections of monorail that are manually shuttled inwards to close in on the approaching underbody. Flexible suspension of the side jigs permits them to be manhandled into location against the central one, and then locked in place by foot-operated toggle clamps.

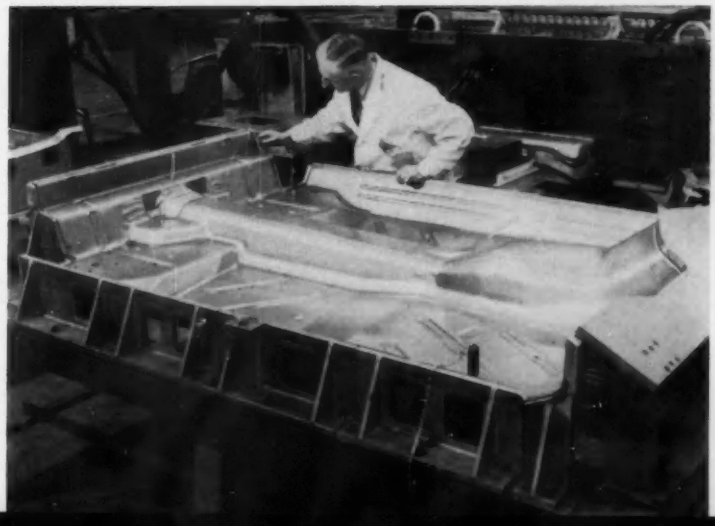
The three jigs remain together for 11 stations, during which time the floor pan and sides are joined and the roof is welded in place. Side jigs are then released and returned empty on shuttling monorails to the start of their lines. Further pressings like the instrument panel and front wheel arches are now added.

Truck-mounted fixtures for the underbody weigh three tons each, and, like the side jigs, can be adapted for either car. While their basic dimensions are different, the two models have a number of minor pressings in common, such as the front seat supports and the rear shock absorber mount reinforcements.

At the end of one full circuit, body shells are hoisted off their base jigs and placed on individual light-weight trolleys engaged by pegs on an underfloor drag chain. As the procession winds through different sections on the floor, body panel joints are soldered and sanded, doors and trunk lids are hung, and external surfaces are finished. (*Continued on next page*)



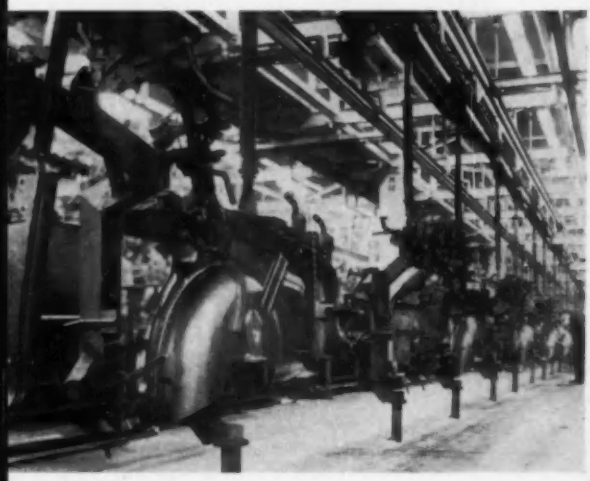




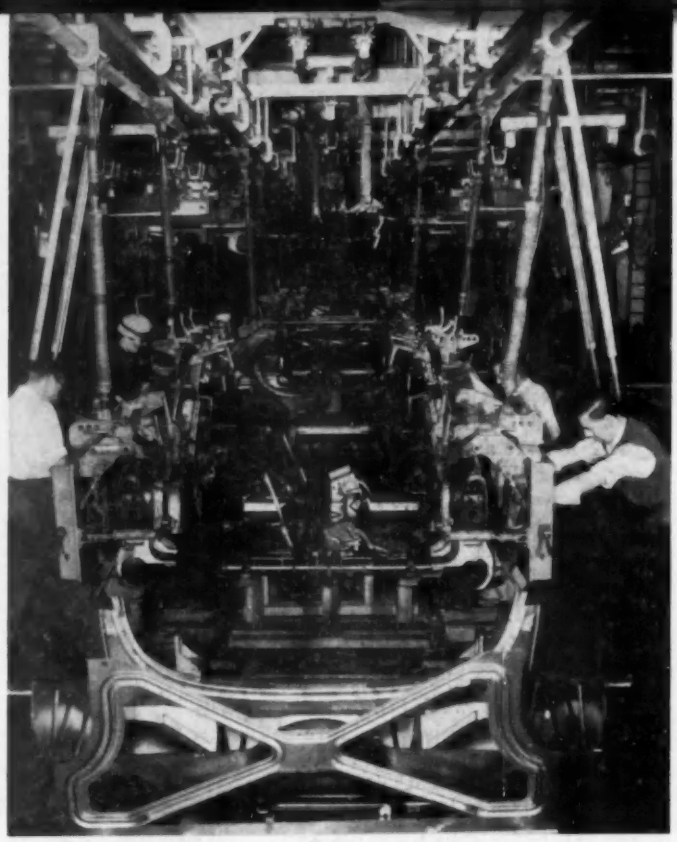
—Top
View of the floor pan welding press.

—Middle
Rectangular blocks from the Lindemann scrap baler are conveyed underground to the loading dock where they are stacked on flat-bed trucks by a magnetic hoist.

—Bottom
Gaging a sample underbody pressing for the Velox/Cresta.



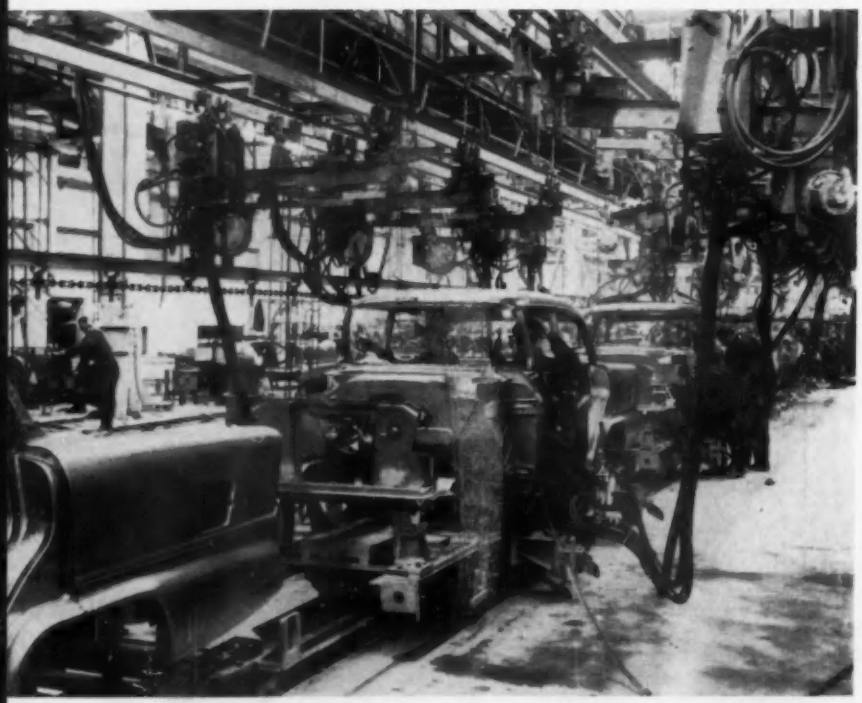
Body-side welding jigs, flexibly suspended from a monorail, unit the pre-assembled fenders, door frames and other parts before being locked to the main underbody jigs.



Looking down a straight section of the oval body-welding line, at the point where the side jigs are swung in and locked to the underbody ones. ▶

Raw bodies are now picked up by an overhead conveyor and carried through a large opening in the ceiling to the first floor for painting and finishing. The continuous paint line comprises a phosphate spray booth, underbody prime dip tank, underseal spray, prime surface spray, and two double coats of cellulose, wet on wet. Several of the booths have batteries of Schweitzer automatic guns, activated when an approaching body intercepts a light beam, that sweep across the exposed surface as it passes by. Bulk supplies of paint are located in a separate building, with individual pipe lines for each of the color options available. Self-sealing couplings on both automatic and hand guns permit an almost instantaneous change.

Painted bodies are then started through the trim line, where they are fitted with fuel tanks, glass, hand and foot controls, instruments, electric wiring, carpets and other parts. Their journey includes two water tests with warm-air drying, and ends at the body-drop point directly above the final as-



Body shells are completed on the main welding line after the side jigs have been removed. Both the Victor and the Velox/Cresta bodies are built on this circuit.

Headlights are aimed and front wheels aligned simultaneously on this GM-designed machine built in England by Gay's (Hampton) Ltd.

sembly line on the floor below.

At the start of the final line, engines and axle assemblies are brought in by conveyor from one of the adjacent engineering buildings. The rear axle and front suspension are first placed on the moving belt, whose trunnion-mounted universal fixtures can be flipped over for aligning with the different wheelbases and treads of the two cars. A few yards further on the mating engine is lowered through a large opening in the ceiling far above.

After leaving the line, cars have their headlamps aimed and wheels aligned simultaneously on a novel machine built to GM design by Gay's (Hampton) Ltd. They are first bounced over a row of corrugations on the floor that settle the shock absorbers in the normal position, then driven into a pair of guide rails that automatically align the spacing of the rollers driving the front wheels. With a car in place, a pushbutton for the corresponding wheels starts the cycle.

Wheels are positively located in their saddles by rollers bearing against the tire walls, and are rotated at a speed equal to 10 mph. Meanwhile, a pair of beam setting units with condenser lenses and photoelectric cells swings forward opposite each lamp. Carried on swivelling arms, they are hydraulically prepositioned for correct height and spacing. While two men aim the lights, a third one in the pit sets the toe-in. The entire operation takes about two minutes, and the machine can handle four different car models without any adjustment.

A second article will describe some of the new machining highlights at the Vauxhall plant in Luton.

• • •

Superhighways in the Sky Previewed by General Motors

An operating model of a tri-level aerial highway will be previewed by General Motors at the Brussels Universal and International Exhibition which opens this month in Belgium.

The top two levels of the core are three-lane, electronically-controlled highways. One level would carry guided cars in each direction. Beneath the lower level is a two-way monorail train system.

GM envisions the core as a straight line route for intercity travel, eliminating curves and hills as it crosses rivers and low areas and burrows through mountains.

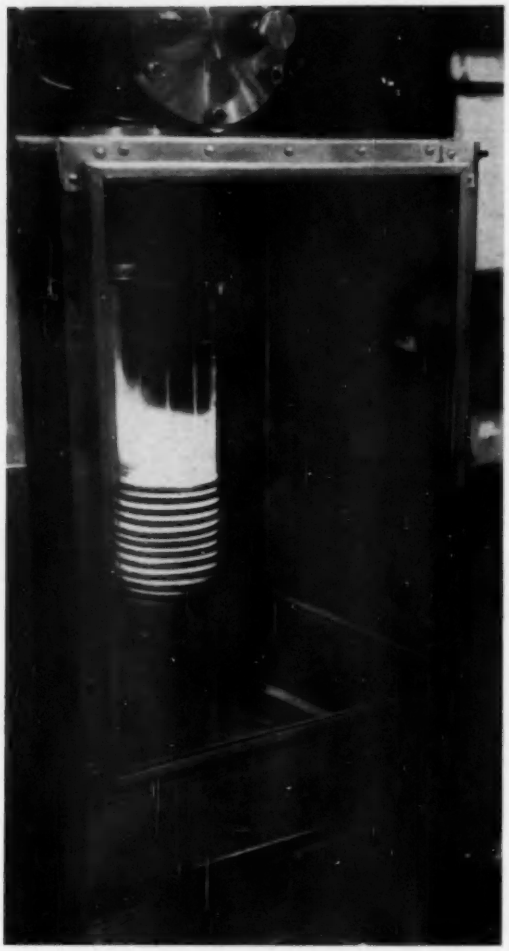
The elevated transit system would be particularly useful, according to GM president Harlow H. Curtice, in Europe and in urban areas of the United States where land is scarce and densely populated.

GM has not held a Motorama, incidentally, since 1955. The new one, which may use New York's Coliseum as its showplace, would preview 1959 model GM products.

New California Firm to Build Small, Low-Cost Helicopters

DeTemple Helicopters, Inc., a newly formed company, announces that it will concentrate on the development of low-cost single and two-place helicopters for the commercial market.

New Static Switches *Revealed* as Westinghouse Opens Plant for Semiconductors



Pictured is one of the furnaces used to "pull" single crystals of silicon or germanium. Before processing, the material is polycrystalline and unsuited for semiconductor devices. This furnace employs an inert argon atmosphere for pulling n-type single crystals—others, for pulling p-type transistor single crystals, use a vacuum atmosphere. Temperatures are 1450 C for silicon and 950 C for germanium.

By Charles A. Weinert

A NEW plant, built from the ground up for the manufacture of semiconductor materials and devices, was recently unveiled by Westinghouse Electric Corp. Also revealed was the development of a semiconductor rectifier that can operate at temperatures up to 1300 F, and a new series of silicon transistors and silicon switches that can handle up to three kilowatts of power in switching applications.

Products of the 160,000 sq ft facility, which is located on a 126-acre tract near Youngwood, Pa., 35 miles southeast of Pittsburgh, are mainly silicon and germanium power rectifiers, power and communications transistors, and silicon rectifier bridge assemblies. Primary emphasis is on semiconductors for power applications. While both germanium and silicon devices are now manufactured, it was said that attention is shifting to silicon devices because of the material's superior high-temperature properties.

Applications

Present or potential applications of the semiconductors, in the form of silicon diodes for rectifying, include use in automotive a-c generators and battery chargers, aircraft alternators, power supplies to d-c motors on machines, welders, plating setups, etc. The devices, in the form of diodes or transistors, either silicon or germanium, are usable in communications equipment, computers, copper refining equipment, radio and television, and electronic business machines, among others. Certain of the transistors are applicable as static switching devices, besides their usual function as amplifiers.

Silicon Facility

One of the latest additions to the plant is a pilot facility for producing silicon with less than one part impurity in six billion parts silicon. This material is being made under an agreement with the Siemens Schuckertwerke and Siemens-Halske companies in Germany which also permits Westinghouse to license the process in the United States. Availability of the "ultrapure" silicon and advancements in fabrication techniques have made possible the development of power diodes and transistors with con-

siderably higher ratings than previously obtainable with commercially-pure silicon.

Manufacture

The manufacturing area of the plant has no windows and is completely air-conditioned. Fourteen 60-ton Freon compressors are used to maintain humidity at 35 to 40 per cent at a temperature of 70 to 75 F.

Manufacture of the devices starts with single-crystal "pulling." At Youngwood, both germanium and silicon polycrystalline materials are "pulled" into single crystals in induction-type furnaces having either inert gas or vacuum atmospheres. The resulting single crystals are in the form of bar stock, which is then sliced into wafers 0.010-in. thick with a diamond cutting wheel. Final silicon single-crystal preparation consists of cutting circular dice of the diameter desired. These usually range from ⅛ to ¾-in. diam, varying in size with the capacity of the unit in which they are to be used. Dicing is accomplished by ultrasonic grinding. Germanium crystal, used solely in transistor devices, is lapped after slicing, acid-etched to the required thickness, and then diced square in shape. Silicon carbide grinding wheels are used to cut the circular slices into square dice for audio-transistor use.

Fusion

For use in semiconductor diodes, the silicon dice must be fused with counter-electrode and ohmic contacts. This procedure entails the making of a sandwich composed of a molybdenum wafer, ohmic solder, the silicon disk, a counter-electrode solder, and another molybdenum wafer. These five-piece assemblies are loaded into cylindrical holes drilled in graphite vessels. The vessels, in turn, are placed into a horizontal-tube vacuum furnace, where fusion of the parts is performed.

Encapsulation

Encapsulation of the fused diodes is done in straight-line operations under enclosed "dry" boxes. These

The new basic silicon power transistor is shown with a conventional low-power computer transistor.

boxes are equipped with elastic-sleeved arm openings at each work station, where Lucite front panels permit full view of the work.

At the beginning of a typical encapsulation line the top header and spring assemblies are made. The top header is a steel cylindrical member with a compression type glass seal at one end that supports a steel center post. A copper spring is soldered to the end of the center post. Next, at the staking station, all of the cell components are mechanically assembled. Here a screw-machined copper stud-type case, a pre-tinned silicon diode, and a mica insulating washer are staked together by an air-operated staking tool and fixture. A solder ring is next placed around the top header, resting against the shoulder of the stud case. A number of these assemblies are loaded onto an aluminum soldering tray, placed on a hot plate, and covered by a Pyrex glass. During the soldering operation a nitrogen-hydrogen mixture is introduced under the cover.

Quality Control

Checks for quality control are numerous and follow all basic steps in the processing. After single-crystal pulling and before slicing, the bars are tested and marked along their circumferences in resistance categories. The slices taken from each section are sepa-

(*Turn to page* 151, *please*)

In the medium power rectifier assembly line, solder rings are placed around the top headers, fitting snugly against the stud cases. The soldering operation is conducted on a hot plate in a nitrogen - hydrogen atmosphere.

By Andrew W. Shearer

Financing for

Commercial Finance Companies Offer Specialized Services and Funds for Current and Future Capital Requirements

ONE of the major problems confronting small and medium-size business today is that of obtaining adequate financing for current operations and future growth. Many companies in this category are unable or unwilling to obtain required working capital from banks, insurance companies, Government agencies, or the public securities markets.

Commercial finance institutions offer an alternate and often advantageous form of interim financing for sound companies which cannot, or do not wish, to obtain funds from other sources. There are approximately 400 commercial finance and factoring companies in this country doing business on a national, regional and local basis. These firms perform the function of supplying immediate funds and credit services to small and medium-size business on a secured basis.

The gross amount of advances on open accounts receivable financed by these companies in 1957 totaled $11.5 billion, compared to a volume of only $1.4 billion in 1941. The growth of the industry is also illustrated by the fact that, in the last decade alone, the capital structure of the typical finance and factoring company has increased by a total of some 300 per cent.

In spite of the phenomenal expansion of the commercial finance industry in recent years, there is still a wide lack of knowledge about its operations. It is the purpose of this symposium-type article to explain the functions of commercial financing with emphasis on ways in which it may help to meet the capital requirements of automotive parts manufacturers and suppliers.

The subject is analyzed from a number of different viewpoints contained in the contributions of several leading executives in the commercial financing field. Pertinent charts and case histories are included with the text.

Commercial Financing—How It Works

By David L. Salinger Director
Industrial Div., Walter E. Heller & Co.

THE following discussion is written in question-and-answer form:

Q: How do industrial financial houses like Walter E. Heller & Co. assist the automotive parts manufacturing and related industries?

A: In one or more of five ways:

1. By supplying working funds to growing companies hampered by today's market and tax conditions.

2. By providing dollars to carry inventory made necessary by such growth.

3. By outright purchase of accounts receivable from a manufacturer or distributor, assuming the credit risks, and handling the collection and ledgering of such accounts (this is properly called "factoring").

4. By enabling sellers of equipment to offer longer terms of sale (or lease) to their customers, and in some cases limiting or taking over entirely the credit hazard.

5. By helping users of equipment to modernize their operations by acquiring cost-saving machinery and equipment.

Q: Do you find a tendency these days toward "package" financing—using several of these methods at once—and if so, why?

A: Yes, we do. The reason is the growth of these industries (making itself felt as "scarcity" of money for handling receivables and inventory), and at the same time growing competition, especially price competition, which puts a premium on cost-cutting through further increases of volume and through use of automatic machinery and modern methods.

Q: Are the costs of funds provided by industrial financing companies higher than bank rates?

A: Yes.

Q: Than dividend rates on preferred stock?

A: Yes.

Q: If so, why do concerns use industrial financing companies?

A: Because they can thereby supplement ordinary indebtedness: get more money, or get it faster, or for longer periods of time, or in a flexible form more adaptable to varying daily and seasonal needs. This is done without need to share earnings or control, or give stock options.

Q: Will you illustrate?

A: Yes. Here's an actual company we'll call the Q Company. They were considering a number of alternative means of securing

Automotive Parts Manufacturers

CONTINENTAL MOTORS CORP. is an outstanding example of a concern able to achieve rapid growth through the use of commercial finance company funds. It is today the world's largest independent manufacturer of internal combustion engines with a range from 2 hp to over 1000 hp.

For the first 25 years of its history, the company was almost exclusively engaged in the manufacture of engines for passenger cars and trucks. As the automobile industry developed toward concentration in a few major companies manufacturing their own engines, Continental Motors Corp. found its list of customers diminishing.

Prior to the acquisition of finance company funds, the company had experienced severe losses. In the year ending Oct. 31, 1933, its total sales were $4,431,858 and the loss was $3,497,763; in the year ending Oct. 31, 1934, on sales of $3,206,207, it suffered a loss of $1,977,619.

Faced with the foregoing situation, the company, in September, 1934, entered into an accounts receiveable financing arrangement and inventory financing program with a commercial finance company. During this decade of the 30's, the company was taking steps to diversify its product line, and it was the use of the revolving credit, available through accounts receivable financing, that provided the much-needed working capital. The finance company provided financing in a situation that other lenders would not consider.

During the period that the finance company provided working capital, Continental Motors Carp.'s sales showed a steady increase, and the losses were significantly lessened. Each year's operation resulted in decreasing the loss from 1933's peak of $3,497,763, with 1937 showing a profit of $71,335.

Other sources of credit showed their confidence in the company as a result of the reduction of losses and new management, and so the finance company arrangements were terminated at the end of September, 1939.

funds. After making an analysis of the needs of the company and deciding that the funds sought would serve a constructive purpose, an industrial finance company made its services and working funds available within a matter of days.

The funds so supplied revolved, in that they were drawn upon and repaid at intervals, as the client's requirements fluctuated up and down. Accounts receivable, notes receivable, all or portions of inventories, and machinery and equipment are generally acceptable as collateral.

When the Q Company's needs were high, additional funds were made available to carry increased receivables and inventories. When Q's needs were less, usage of funds was reduced correspondingly, with no prepayment premium. This cycle can be repeated as many times as necessary.

In a typical operation, the client pays monthly for the use of funds, payment being based on the *average actual net* amount in use daily during the preceding month. The client is thus enabled to draw funds as he needs them.

As an example, payrolls may be on the 1st and 15th of each month, and suppliers' invoices may be discountable on the 10th of each month. Funds may be obtained on precisely those dates and need not lie idle in the client's bank account. The great flexibility of this procedure materially reduces financing cost to the client.

Q: Would your example also cover factoring?

A: No. The Working Fund I have described was the right answer for Q Company; factoring might be better for Company X; maybe Company A ought to stick to its present limited bank credit, or go on the open market for debenture funds or a stock issue.

ANNUAL VOLUME OF FINANCING AND FACTORING OF ACCOUNTS RECEIVABLE

(1940-1957)

	Commercial Finance Companies	Factors
1940	$411 million	$780 million
1941	536 million	1.14 billion
1942	681 million	1.44 billion
1943	885 million	1.49 billion
1944	1.17 billion	1.50 billion
1945	1.24 billion	1.56 billion
1946	1.89 billion	2.41 billion
1947	1.90 billion	2.43 billion
1948	1.92 billion	2.49 billion
1949	1.95 billion	2.10 billion
1950	2.00 billion	2.70 billion
1951	2.10 billion	2.80 billion
1952	2.46 billion	3.10 billion
1953	2.76 billion	3.10 billion
1954	3.15 billion	3.15 billion
1955	4.90 billion	3.70 billion
1956	5.60 billion	4.30 billion
1957	6.50 billion	4.50 billion

* Source: National Commercial Finance Conference, Inc.

Q: Are funds readily available from industrial finance companies even in today's money market?

CHARACTERISTICS OF FACTORING AND FINANCING

	OLD-LINE FACTOR**	COMMERCIAL FINANCE COMPANY
1.	Purchases accounts receivable outright without recourse for failure of the customer's credit integrity.	Generally acquires a security title in receivables pledged as security for a loan.
2.	Notifies customer of purchase of accounts receivable and collects directly in his own name.	Generally customer is not notified of pledge of accounts receivable; collections are made by borrower as trustee for finance company or bank and forwarded by borrower to loaning institution.
3.	Posts a detailed accounts receivable ledger; often prepares and mails customers' invoices.	Often does not keep a detailed receivable ledger but only a summary receivable control account to indicate day-to-day changes in total pledged receivables; does not prepare invoices.
4.	Advances the purchase price of receivables before maturity; makes additional loans to factored companies on their own paper and against merchandise and other collateral.	Similar financing service, except that loans other than advances against pledged receivables are practically always secured.
5.	Often works closely with the factored company in the choice of selling agents and the determination of selling policy.	Generally is not so closely associated with the borrower.
6.	Occasionally provides "house" facilities or space on the factor's premises for the storage and display of merchandise and maintenance of selling office.	This service is not rendered by the commercial finance company or bank.

* Source: National Commercial Finance Conference, Inc.

** The term "old-line factor" refers to a company whose principal business is that of purchasing receivables outright without recourse as opposed to lending against the security of receivables.

A: Certainly, but no professional industrial finance man will propose using such funds until he is satisfied they will do the job better than other methods; otherwise he puts the client and his own company in a bind.

Q: These are all fairly technical matters. How can, say, a manufacturer of automotive parts arrive at the right answer?

A: Consult his own financial officers for the facts on his company, decide what program he would like to accomplish, and call in one of the industrial finance companies, for a consultation (without obligation or fee) as to the best means.

Commercial Financing Promotes Business Growth

By Edward J. Fitzgerald

Assistant Vice-President and Business Development Director, James Talcott, Inc

THE securing of revolving capital funds is one of the biggest problems facing automotive parts manufacturers and suppliers. Taxes, expanded production facilities, higher inventory requirements, larger accounts receivable, and increased labor and material costs have eaten heavily into reserves. Funds formerly readily available from banks and other lending institutions have tended to dry up in a "tight" money market.

The commercial finance industry offers the interim financing required by such businesses. Companies such as James Talcott, Inc., offer revolving capital funds to finance working capital requirements. Talcott has found that manufacturers in this field often require a loan on machinery—either to produce products or acquire new equipment—and subsequently utilize loans against the collateral of accounts receivable (on non-notification of debtor basis) to give two sources of liquidity to both producing and working assets.

Both types of loans operate on a continuing revolving fund basis, with no fixed due dates and flexibly expanding as sales and receivables expand. All charges are on cash balances owing, not on term notes basis. Often these methods of financing are supplemented by loans on raw or finished inventories for specific purposes as accommodation for specific term.

Here is an actual case history from the files of James Talcott, Inc., indicating how a sound commercial financing plan contributed to the success of a firm which may be called the ABC Corp., a Detroit automotive parts producer.

Organized in 1953 by three men who already owned a successful tool and die company, ABC confined most of its activity to experimental work for the first two years of its existence. The firm grew in stature and by mid-1955 had a backlog of orders of approximately $1 million. However, working funds were desperately needed to keep the plant in operation.

The three owners tried to obtain the required funds from local banks, but the combination of the company's poor net worth position and "tight" money made such a loan impractical from the bank's point of view. Bank officials referred the firm to Talcott.

At that time, ABC's current assets amounted to $67,000; it had deposits of $7000; and machinery and equipment worth $34,000. Trade and accrued liabilities

(*Turn to page* 126, *please*)

Airslide Conveyor System Handles Raw Materials at AC Spark Plug Plant

AC Spark Plug Div. in Flint, Mich., is using a specialized air conveyor system to transfer the materials used in manufacturing spark plug insulators.

Backbone of the system is a network of enclosed conduits called Airslides, through which the material rides on an inner false bottom of fabric. A stream of low pressure air below the fabric filters through the fabric and aerates the powdered materials.

Because the conduits are set at a slight angle the air-fluidized material (basically powdered aluminum oxide) flows through the stationary conveyors by gravity as though it were liquid.

In a sense, the powdered material is suspended on air. In no way, however, does the air force the powder along its course. Because the powder does flow so easily, it retains its desired shape and size throughout the downhill transfer.

AC has approximately 2250 ft of Airslide at its spark plug plant in Flint, Mich. The system has been in volume operation since 1954 and in limited use since 1952. When material is moved horizontally, the Airslide transfer system is used.

But Airslide is only a part of the overall transfer system. Vertical movement of material is through one of two pieces of equipment, either an Airlift or a Fuller Kenyon pump. In either lift, the powdered material is first aerated to render it fluid and then driven up a pipe by air pressure.

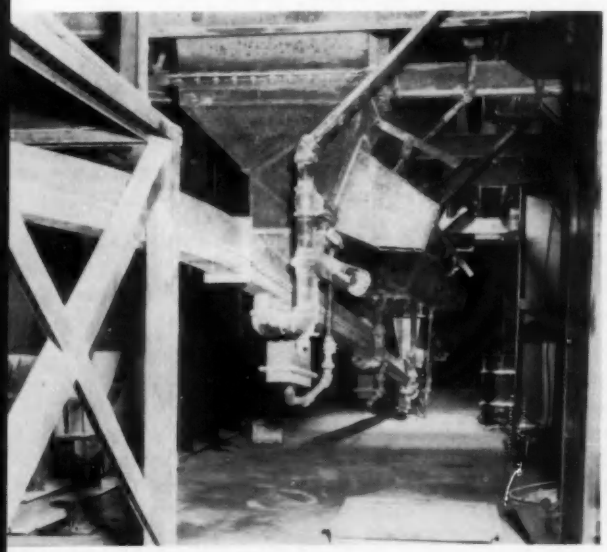
At present these lifts are too rough on the material in its final stage of processing, and the pneumatic lift is not being used to deliver the processed material to the presses for forming the insulator blanks.

The air pressure breaks down the granulated material from the desired shape and size. AC engineers expect to have this problem solved in the near future so that all material can be handled automatically in the enclosed pneumatic conveyor system.

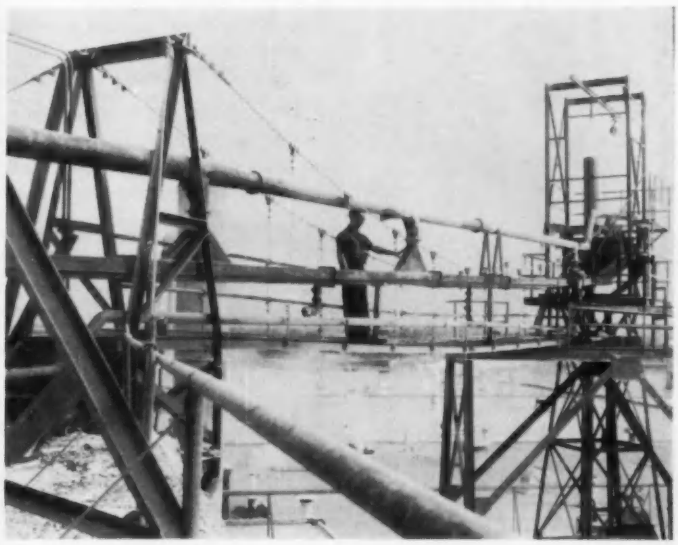
Briefly, here is the way the system operates. Aluminum oxide is delivered to the plant in hopper-type rail cars and moved, via lift and Airslide, to storage bins on the roof of the plant. From there it moves by gravity through a weighing operation to ball mills on the main floor.

(*Turn to page 98, please*)

Section of the Airslide transfer system used at AC Spark Plug's plant in Flint, Mich. These hoppers drop milled powder, from ball mills on the floor above, into Airslide ducts.



An AC employe checks a section of the Airslide system on the roof of the spark plug plant. This Airslide bridge carries raw material (aluminum oxide) from roof-top storage bins to hoppers on the floor below for weighing and distribution into ball mills.



Preview of the 1958 Tool Show of the ASTE

...Tooling for Competition...

WITH a timely theme "Tooling for Competition," the 1958 Tool Show and concurrent 26th Annual Meeting of the American Society of Tool Engineers will open on May 1. Philadelphia's Convention Hall is to be the center for both the show and technical sessions, which are scheduled to run over the period May 1 to 8, inclusive. More than 35,000 visitors are expected to participate in the vast program that has been arranged.

At the show there will be some 470 exhibits of equipment and products valued at well over $10 million. Show hours are 9:00 AM to 6:00 PM daily, except for Sunday, May 4, when the show will be closed. On display will be latest production equipment, accessories, processes, services and aids, occupying 155,000 sq ft of Philadelphia's Convention Hall. Equipment will include machine tools, precision control equipment, cutting tools, automatic assembly machines, and workholding devices. Makers of precision gaging and inspection equipment will present new techniques in quality control. Grinding and finishing equipment, presses, abrasives, cutting fluids, and many other products will likewise be displayed in their newest forms. Highlights of some of the new equipment to be exhibited in the huge show are given in the following pages.

In the technical sessions, latest production methods will be discussed by specialists and experts in various fields. More than 100 papers, panels, seminars, and symposiums are programmed. Automation, numerical control, powder metallurgy, metal cutting, nuclear tooling, European progress, and guided missile production are among the major subject categories. Two symposiums will be devoted to numerical control and tooling for metal powder parts. An innovation this year will be a special two-day metal-cutting-review seminar, for which separate registration will be required, in which basic metal-cutting technology is to be comprehensively covered. Topics for the conference will also encompass plastic tooling, ceramic and carbide tools, diamond tools, gear production, automated machines for low-production parts, and tooling for new aircraft materials. The technical meetings are to take place at Convention Hall, the Bellevue-Stratford Hotel, Franklin Institute, and the Sheraton Hotel in Philadelphia.

The annual Eli Whitney Memorial lecture will be delivered this year by D. J. Davis, vice president—manufacturing, Ford Motor Co., during luncheon meeting on May 6 at the Sheraton Hotel. He will carry out the theme of the show and conference in presenting a treatise on "Planning for Profit."

Additional events scheduled are: the Honor Awards Dinner at the Benjamin Franklin Hotel on May 5 in honor of ASTE's six meritorious award winners; and the 26th Annual Installation Banquet to be held on May 7 at the Sheraton Hotel. Sunday, May 4, has been set aside for a day of relaxation at Atlantic City, N. J.

Thirty tours of 16 different plants have been arranged. Among the manufacturing plants to be visited are: The Budd Co., Fischer & Porter Co., I-T-E Circuit Breaker Co., Leeds & Northrup Co., Link-Belt Co., Minneapolis-Honeywell Regulator Co., Plymouth Div. of Chrysler Corp., Schramm, Inc., Simonds Abrasive Co., Standard Pressed Steel Co., United States Steel Corp., and the Yale & Towne Mfg. Co. The Philadelphia Naval Shipyard will also be toured.

1958 ASTE Tool Show

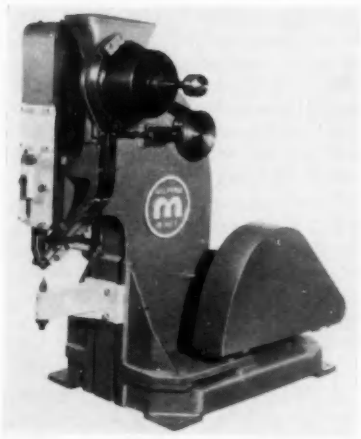
Here's What's New!

PHILADELPHIA
Convention
● Hall ●
MAY 1-8

Riveting Equipment

Riveting equipment for automatically feeding and setting tubular and split rivets will be featured in the Milford display.

Shown is the Model 54, a single-spindle heavy-duty bench riveter, which is designed to feed and set ⅛ and 5/32 in. diameter semi-tubular



rivets from ⅛ through ¾ in. in length. It is equipped with a quick-change hopper and raceway for conversion from one rivet size to another. *The Milford Rivet & Machine Co. Booth No. 1671.*

Circle 25 on postcard for more data

Cemented Oxide Inserts

Precision machining of AISI 52100 steel using Carboloy grade 0-30 cemented oxide will be demonstrated. The steel, with a hardness range of 60 to 62 Rc, will be machined at 600 sfpm for fine surface finishing. An enlarged offering of stocked cemented oxide, which includes square, triangular and round disposable inserts and cylindrical blanks will also be on exhibit.

Carboloy Lift-O-Matic tool holders with the standard grade 0-30 inserts and man-made industrial diamonds used in standard resinoid bonded six-in. cup-type wheels will be in operation. *Metallurgical Products Dept., General Electric Co. Booth No. 1770.*

Circle 26 on postcard for more data

Tape Control System

The Bendix Tape Control System which includes a tape preparation unit and a machine control unit that operates a machine tool will be the feature of the Bendix Aviation Corp. exhibit.

The tape preparation unit consists of a Flex-O-Writer, a computer, an auxiliary magnetic tape storage unit and a control tape punch. The Flex-O-Writer produces the process tape from information contained on a process sheet. The computer converts the process tape part information

FOR ADDITIONAL INFORMATION
please use reply card on Page 89

such as tool center path, feeds, etc. to a punched control tape.

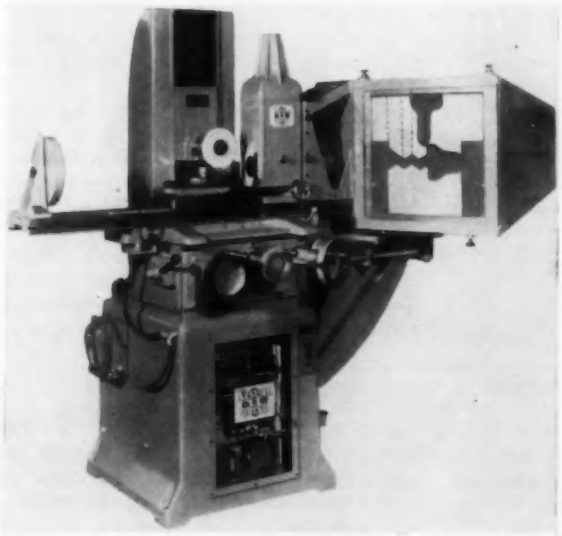
The machine control unit consists of a hydraulic power supply, electronic machine control unit, servo drives and feedback units. The control unit receives, stores, decodes and relays command pulses from the control tape to the servo drives of the machine tool. The feedback units are driven by the machine leadscrew or by precision gear racks on moving members. The difference between the feedback pulses and the number of control pulses is converted to a proportional voltage which controls the hydraulic servo valves which in turn controls rotary piston hydraulic motors. *Booth No. 936.*

Circle 27 on postcard for more data

Optical Projection Grinder with Ground Glass Viewer

Continuous lubrication, a timer belt, 110 v electrical control and close tolerance downfeed are among the features to be seen on the VG-3 Visual Grind optical projection grinder. The unit enables the form grinding of steel and tungsten carbide to precision tolerances. This is accomplished by projecting the workpiece on a ground-glass viewing screen with magnification systems ranging from 10:1 to 100:1. The workpiece is ground and inspected on the screen enlargement. (Cleveland Grinding Machine, Co. Booth 838.)

Circle 28 on postcard for more data



1958 ASTE Tool Show

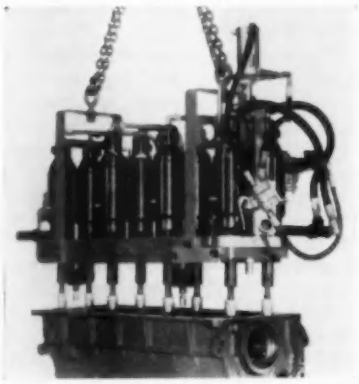
Here's What's New!

PHILADELPHIA Convention Hall MAY 1-8

FOR ADDITIONAL INFORMATION please use reply card on PAGE 89

Eight-Spindle Nutsetter

The Cleco 8-430-NS eight-spindle nutsetter which runs ten main bearing cap bolts in a Diesel truck engine will be on display. Hung from a balancer, the unit is guided to the work by two dead handles. When the driving sockets are located on the bolts, a thumb-operated valve is de-



pressed to start the motors, which then drive eight of the ten bolts to stall torque simultaneously. The supplementary index feature is utilized to drive the two bolts in the rear main bearing cap after the initial rundown of the eight bolts. Each motor is equipped with an integral pressure regulator.

A heavy-duty ⅜ in. bolt capactiy air impact wrench for tightening and removing bolts and a line of pneumatic grinders designed for a variety of metal grinding, sanding and wire-brushing operations will also be shown. *Cleco Div., Reed Roller Bit Co. Booth No. 1871.*

Circle 29 on postcard for more data

Self-Feeding Drill

A self-feeding drill, three abrasive tools and a "one shot" clutch will be shown by Buckeye Tools Corp. The drill, capable of drilling, tapping, reaming, counterboring and countersinking has a capacity of 3/16 in. and a stroke length of two inches.

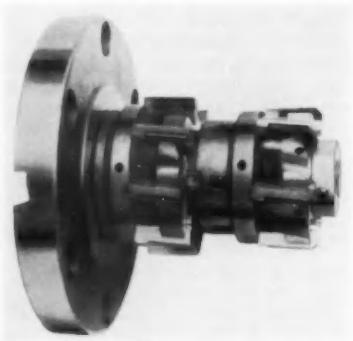
The clutch, to be available on most Buckeye fastening tools, has a ball and roller design which stops the tool the instant the pre-determined limit of torque has been reached.

The other tools: a horizontal grinder, a vertical sander and a compact abrasive tool, designed for various grinding operations, feature a built-in muffler for quiet operation. *Booth No. 705.*

Circle 30 on postcard for more data

Multiple Cutting Tools

Barber-Colman Co. will show its line of Mult-O Tools which are designed for high-production, transfer type operations, and combine multiple



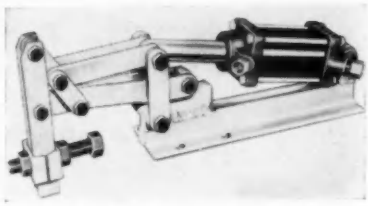
operations in single machining cuts on modern transfer type machines. Most cutting edges are carbide tipped inserted blades.

A total of 19 tools ranging from 0.220 to 6.250 in. are used, combining multiple operations for facing, hollow milling, boring, reaming and chamfering. *Booth No. 1255.*

Circle 31 on postcard for more data

Air-Operated Clamps

Lapeer Manufacturing Co. will feature a series of heavy-duty, air-operated clamps in their display. The clamps, in the 800 lb classification, are available in several models. One for conventional holding operations and one for difficult mounting situa-



tions as when the cylinder interferes with conventional clamping. *Booth No. 833.*

Circle 32 on postcard for more data

Carbides and Toolholders

Vascoloy-Ramet Corp. will show two steel-cutting grades of carbide: V-R 73 and V-R 77.

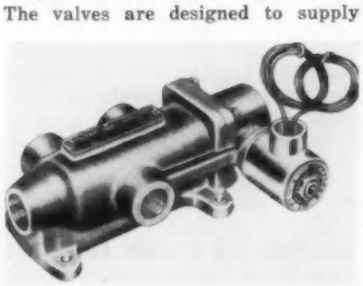
V-R 73 is especially compounded to produce maximum results in the minimum shock range with high resistance to cratering and edge wear. V-R 77 has been developed for use in applications requiring high resistance to mechanical shock. Both grades are available as standards in full-length and throw-away inserts.

The display will include a complete line of fixed-base toolholders used with throw-away inserts. *Booth No. 1035.*

Circle 33 on postcard for more data

Four-Way Valves

Four-way solenoid actuated valves will be exhibited by A. Schrader's Son, Division of Scovill Mfg. Co., Inc. The valves are designed to supply



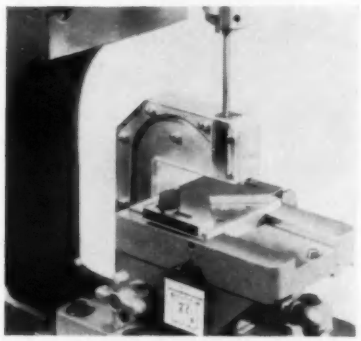
full line air pressures to cylinders from a remote position using solenoid action and are available in single or double solenoids.

The valv s are obtainable for 110 or 440 v ac current in four sizes; ¼, ⅜, ½ and ¾ N.P.T. and are suitable for continuous or intermittent duty. Base plates for basic valve housings are also available. *Booth No. 1634.*

Circle 34 on postcard for more adta

Fixture, Checking Balls

Standard and custom-built stainless steel fixture and checking balls used as reference points in jig and fixture work, and custom-engineered anti-friction ball and roller bearings of special shapes, sizes and alloys will be on display. In the same booth



will be a ballizing machine and fixture used in the ball hole method of hole sizing and finishing. *Industrial Tectonics, Inc., Booth No. 427.*

Circle 35 on postcard for more data

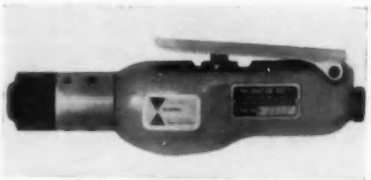
Powder Metal Parts

Amplex Div. of Chrysler Corp. will have a briquetting press in operation and will show how machining is eliminated by die pressing metal powder directly into finished shapes. Many Oilite parts now being used by the appliance, machinery, powder tool, farm equipment, transportation and other industries will be displayed. In addition, a number of large powder metal bearings made by the "silver soldering process" will be shown. *Booth No. 1839.*

Circle 36 on postcard for more data

Pneumatic Hammer

The Model SP-2-900B Bantam bully air hammer which is designed with a straight handle for easy, one-hand



operation in close quarter or blind spot work will be shown at the Superior Pneumatic & Mfg. Inc. booth. It can also be suspended from overhead reels for use on production lines.

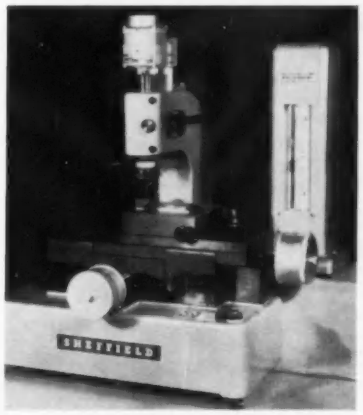
Measuring 7¼ in. long, weighing 20 oz and using 6.5 cfm of air, it lets the operator control blows from 0 to 13,000 per minute through a metering trigger. The slip chuck easily snaps in or out the 24 tools used for scaling, chiseling, peening, Speed or Palnut assembly, paint scaling, etc. Tools can be locked in eight different positions. *Booth No. 1929.*

Circle 37 on postcard for more data

Precision Gaging Unit

Pictured is the Precisionaire Hole Coordinate Measuring Machine which will be seen in the Sheffield booth. It is used to determine the precise location of holes in precision-made parts such as bearing plates, computer and instrument stacks and frames.

The gage consists of a heavy cast



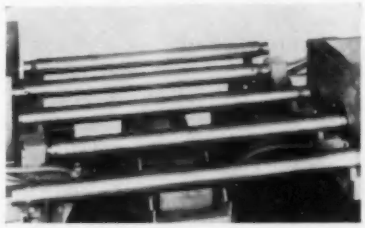
base on which is mounted a serrated work table that is adjustable through both horizontal planes. Above the table is an overhanging arm that has a pickup stylus connected to an instrument which amplifies and indicates gage reading. The 4 in. diameter barrel micrometers have one inch gage reading and are graduated in ten millionths. *The Sheffield Corp. Booth No. 222.*

Circle 38 on postcard for more data

Tube Trimming Machine

Vulcan Tube Co. will show a tube trimming machine capable of trimming tubing 24 to 72 in. long. It is completely automatic in that it picks up the tubes from an idle station outside the machine, carries them through, trims both ends and then deposits them in an idle station outside the machine. The die will accommodate various diameters of tubing up to 4 in. OD. Wall thicknesses can vary from 0.093 down.

Straight, bulged or reduced tubing can be trimmed and held to tolerances of ±0.005. Tubes are trimmed from the inside out and are free of burrs. Tubing is full metal thickness at the



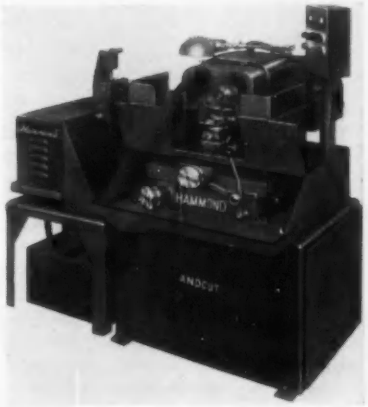
trimmed edge and there are no steps or tube distortion. Both ends are trimmed by means of Brehm "Shimmy" dies hydraulically operated and horizontally mounted. Tubes are inserted by hydraulic cylinders and withdrawn by electro-magnets. *Booth No. 1404.*

Circle 39 on postcard for more data

Double End Chip Breaker

An electrolytic double end chip breaker and cup wheel grinder for carbide tools will be in operation at the Hammond booth. The unit is built with a 150 amp Anocut power pack in the base.

The main drive is a ¾ hp motor-on-spindle grinding head that has precision bearings. The table on the chip breaker side travels on ball bearing ways and has an eight in. stroke. Mist and fog are controlled by proper



hooding of both ends of the machine. *Hammond Machinery Builders, Inc. Booth 1704.*

Circle 40 on postcard for more data

1958 ASTE Tool Show

Here's What's New!

PHILADELPHIA Convention Hall MAY 1-8

FOR ADDITIONAL INFORMATION please use reply card on PAGE 89

Thread Rolling Heads

The National Acme Co. will demonstrate their line of Vers-O-Tool threading and hollow milling heads and Acme-Fette self-opening thread rolling heads which will be mounted on the turret of a single spindle automatic that provides two forward and two reverse spindle speeds in one

cycle of the machine. Automatic die heads that use a line of circular and adjustable blade ground thread chasers or cutters for end forming and end turning will also be shown. *Booth No. 2115.*

Circle 41 on postcard for more data

Heat Treating Machines

The Cincinnati booth will feature a precision selective flame heating machine and a high frequency induction heating machine.

The Filmatic flame heating machine, incorporating the building block principle of construction, is of functional, flat bed design having a large, flat open area on which a variety of flame heads and work handling fixtures can be mounted. The unit will perform simultaneous spot-hardening of the cup and pad sections of automotive rocker arms, six at a time. Constant quenching conditions are assured by the large volume of the quench tank, high capacity heat exchanger and automatic quench agitation system. A built-in conveyor removes the finished parts.

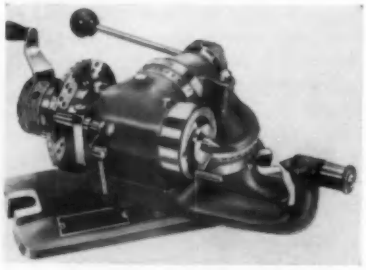
Simultaneous hardening of both ends of automotive push rods will be accomplished by use of the high frequency induction heating unit. On this machine, parts are loaded by hand into a magazine type loading fixture, which in turn, loads them into notches in the periphery of a rotating drum type fixture. As the parts are carried by the drum, each end is passed through an arc-shaped heating coil which heats it by induction as it passes along the coil. Rate of production is one push rod each second. *The Cincinnati Milling Machine Co. Booth No. 1555.*

Circle 42 on postcard for more data

Indexing Fixture

Featured in the Eastern booth will be the "All Tool" universal collet indexing and grinding fixture which can be setup for any compound angle, all divisions. It can do flat and cylindrical grinding on surface grinders in one setup. Actual work will be performed with this fixture on a Sanford surface grinder.

Other tools included in the exhibit are Anton hardened and ground parallel sets, adjustable magnetic "V"



blocks with vernier settings and an adjustable magnetic work holder. *Eastern Machine & Tool Co. Booth No. 431.*

Circle 43 on postcard for more data

Solenoid Pilot Valve

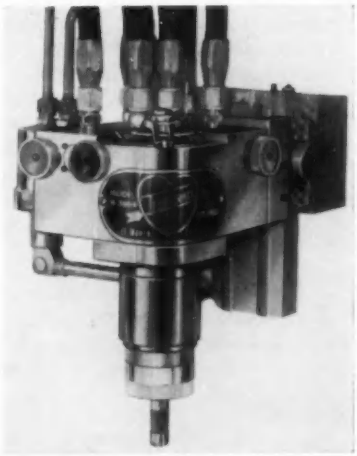
A variety of Ross Skyline Series valves featuring long life and interchangeability of heads and bodies will

be on exhibit. Pictured is the Silver Model spool solenoid pilot valve, which has a tested life of more than 25 million cycles, mounted on a three-way incline and a four-way base-mounted valve. *Ross Operating Valve Co. Booth 814.*

Circle 44 on postcard for more data

Numerical Tool Control

True-Trace Sales Corp. will display, in full operation, a numerical control system and a line of hydraulic tracer controls. Featured in the display, the



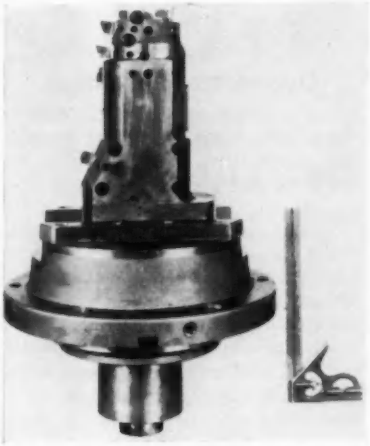
Model B-360A fully automatic tracer, can be changed from fully automatic 360 deg to a pencil or manual 360 deg seconds.

The True-Trace numerical control system and a 180 deg tracer lathe application will also be demonstrated. *Booth No. 2135.*

Circle 45 on postcard for more data

Feed-Out Heads

Cutter heads for original equipment makers to perform intricate machining operations will be seen in the Gairing booth. In operation, this head does cross facing, grooving and undercutting. The tool block feeds out and the counterweight, which is link-



ed to the main bell crank, feeds out in the opposite direction to counterbalance.

The main head is attached to the spindle of one of the machine units. The entire unit moves forward to a positive stop and an auxiliary cylinder in the back of the unit then creates the actuating motion. *Gairing Tool Co. Booth No. 318.*

Circle 46 on postcard for more data

Gear Tooth Honing Tools

Red Ring gear tooth honing tools for performing hard-gear tooth finishing operations on spur or helical external and internal gears will be displayed by National Broach & Machine Co. These abrasive-impregnated, plastic, gear shaped honing tools are designed to improve hardened gears by removing nicks and burrs and making minor tooth shape corrections.

Other cutting tools to be shown will include broaches for round holes, flat surfaces, splined holes and irregular shapes. *Booth No. 922.*

Circle 47 on postcard for more data

Thread Forming Device

The Besly "X-Press" tap which cold forms internal threads without cutting in copper, brass, aluminum, lead, zinc, die castings, leaded steels and other ductile metals will be on exhibit. The thread is formed under pressure and the tap itself has no flutes or cutting edges. Tap breakage due to chips is eliminated as there are no chips produced.

A working demonstration, set-up on a turret drilling and tapping machine, showing X-Press tapping advantages and a line of carbides which include toss-away inserts can also be seen. *Besly-Welles Corp. Booth No. 632.*

Circle 48 on postcard for more data

Steel, Aluminum Facility

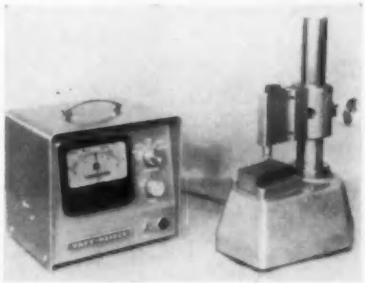
Facilities for supplying flat rolled steel and aluminum in "first operation" blanks, multiple cutting sizes and coils will be pointed out in the Ryerson exhibit. Quality control equipment and methods, including a spark testing demonstration, will also be featured.

Automatic cut-to-length machinery which decoils, levels, and cuts coil into flat sheets, slitters for producing coils of various widths, and batteries of shears that cut blanks and strips are included in the line of equipment operated by *Joseph T. Ryerson & Son, Inc. Booth 1036.*

Circle 49 on postcard for more data

Electronic Gage

The Versachek, an electronically operated gage that converts minute dimensional variations to voltage changes and amplifies to read on a meter will be in the Taft-Pierce exhibit. The basic installation consists of an electronic amplifier connected to a pickup head, mounted either on a heavy duty comparator stand or height gage stand. Gaging is based on

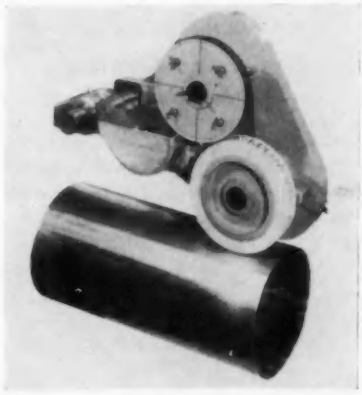


a comparison of product dimensions to gage blocks or other suitable masters. *The Taft-Pierce Mfg. Co. Booth No. 219.*

Circle 50 on postcard for more data

Marking Equipment

The No. 248 offset printer, designed for continuous, lineal printing on steel, aluminum or plastic pipe, bars, tubing or other like products will be featured in the Matthews exhibit. Mounted directly over a moving pro-



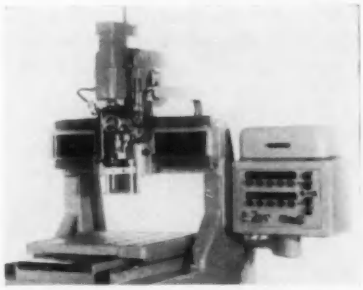
duction line, it is capable of printing on an unlimited rane of product sizes from ½ in. OD. *Jas. H. Matthews & Co., Inc. Booth No. 1324.*

Circle 51 on postcard for more data

Drilling Machine

Hillyer will display a fully automatic numerically controlled machine which is available with combined manual dial and punched tape controls or with dial control only.

All punchings are directly readable



in decimal columns. The bridge-type construction gives good rigidity and accuracy with a minimum of floor space and maximum work size. Machine accuracy is 0.001 in. per ft and rapid traverse speed is 100 in. per minute. It is available in several models with capacity ranging from ¾ in. drill with 2 hp spindle motor down to ¼ in. drill multiple spindle units for printed circuit work. *Hillyer Instrument Co., Inc. Booth 1701.*

Circle 52 on postcard for more data

1958 ASTE Tool Show

Here's What's New!

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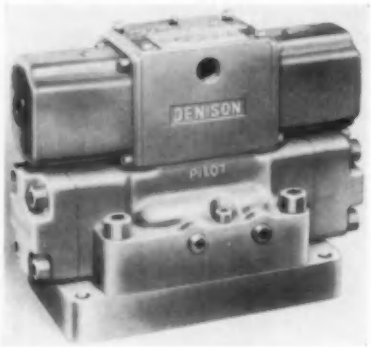
Hydraulic Controls

The Denison exhibit will feature a complete line of hydraulic pumps, motors and controls for hydraulic service up to 5000 psi. The motors and controls to be shown are the type be-



ing incorporated in the design and construction of tooling equipment for automatic and semi-automatic production, as well as complete automation.

Shown is the pilot-operated, solenoid-controlled 4-way valve which is designed to provide all porting and positioning arrangements on circuits up to 3000 psi. Capacities are 30 gpm and 5 gpm for the ¾ in. pilot and ¼ in. solenoid valves respectively. *Denison Engineering Div., American Brake Shoe Co. Booth No. 1012.*

Circle 53 on postcard for more data

Precision Tools

Brown & Sharpe will display various lines of precision tools, metal cutting tools, screw machine tools and pumps. In addition, the Direct Reading Micrometer (D.R.M. 200) which measures from 0 to 1 in. by ten-thousandths of an inch will be shown along with many different gages and related equipment.

Clear plastic windows of the D.R.M. 200 show numbers indicating thousandths, in units of five thousandths. The lever action floating clamping arrangement allows easier, positive clamping and does not disturb spindle alignment. The micrometer is easily adjusted for surface wear or zero setting, and has long wearing, carbide measuring faces and one-piece hardened, precision ground and lapped spindle and screw. *Brown & Sharpe Mfg. Co. Booth No. 122.*

Circle 54 on postcard for more data

Hardness Testers

The testing for and the determination of hardness of materials, metals and their alloys will be the topic of the Wilson display. A combination normal and superficial Rockwell hardness testing unit named the Twin-Tester; a Size 3 automatic feed and discharge floor model tester capable of making 1000 tests per hour; motorized and semi-automatic Model Y units; hand-operated testers; Superficial and Michrohardness testers as well as a line of accessories will comprise the exhibit. *Wilson Mechanical Instrument Div., American Chain & Cable Co., Inc. Booth 309.*

Circle 55 on postcard for more data

Balancing Machine

The Tinius Olsen Testing Machine Co. will show their vertical dynamic balancing machine for jet aircraft en-

gines. This machine can handle the individual stages of the turbines and compressors, as well as, balance the turbines and compressors as sub-assemblies. The machine will always remain in calibration due to the use of compensators, eliminating a time consuming operation. The Rava Olsen Static-Dynamic balancing machine pictured will also be shown as well as the Vibrodyne unit. *Booth No. 1023.*

Circle 56 on postcard for more data

Conversion Coatings

Oakite Products, Inc. will demonstrate the Oakite CrysCoat Process for phosphatizing and Oakite Chromi-Coat for conversion coating of aluminum.

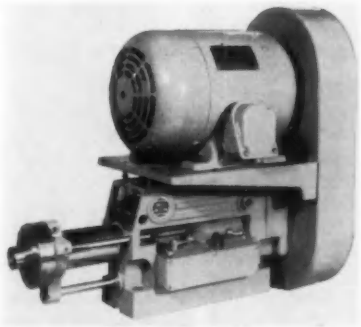
In the demonstration, metal panels will be processed through a simulated production line to show the simplicity of application and effectiveness of the coating. Also to be demonstrated is Oakite Rustripper, the alkaline, rust, oil and paint remover; Oakite Stripper SA for the removal of epoxy resin finishes; and Oakite Composition No. 3 for barrel finishing. *Booth No. 641.*

Circle 57 on postcard for more data

Drilling, Tapping Units

The Drillmation standard unit Model 800-H.D. which has a self-contained, locked circuit hydraulic pump will be displayed.

In application, a drilled hole ¾ in.



in diameter was required through a one inch thickness of a super alloy with the following characteristics: Rockwell hardness of 56-58 C scale and a 310,000 lb to the sq in. of tensile strength. Using a standard Model 800-H.D. drilling unit and a standard carbide drill with ordinary soluble oil as a coolant, the required hole was drilled in 80 seconds. *Drillmation Co. Booth No. 1371.*

Circle 58 on postcard for more data

News of the MACHINERY INDUSTRIES

February Machine Tool Orders Show Increase Over January Results, and Overall Tone of Market Is Firmer. NMTBA Official Urges Industry Support by Government

By Charles A. Weinert

February Machine Orders Show Some Improvement

Net new orders for metal-cutting-type machine tools rose 18 per cent in February over January. The February figure is $22.85 million as compared to $19.3 million in January and $18.65 million in December, 1957.

Orders for forming-type machine tools, not reported in past years but now being given, fell from $7.55 million in January to $5.45 million in February. However, if the cutting-type and forming-type new orders were combined, the February total figure would show an increase over January of about five per cent.

Shipments in February of metal-cutting-type machine tools amounted to about $38.4 million, versus $47.75 million in January. The corresponding figures on forming-type machine tools were $10.05 million in January and $9.5 million in February.

Ludlow King, executive vice president of the National Machine Tool Builders' Association, recently issued a statement coincident with the release of the February results. He said, "the overall tone of the machine tool market is definitely firmer and requests for quotations are increasing," but "it is still a long way back to the reemployment of the estimated 30,000 men who have been laid off and to providing five-day work weeks for those presently working three and four days." Three steps that could be taken to alleviate the situation were outlined by Mr. King as follows:

"For immediate improvement, the Defense Dept. should use uncommitted funds to replace old and obsolete machine tools as prescribed by the Defense Dept. machine tool replacement program.

"The House of Representatives should pass the recently-proposed bill S.2595 introduced by Senators Sparkman and Thye and the Senate should pass the companion bill H.R.10830 introduced by Representative Henry Reuss. These bills would permit the Defense Dept. to maintain modernized production equipment without asking for any additional funds whatsoever. Lease money received from Government-owned machine tools would adequately provide sufficient funds.

"The Administration should adjust its foreign reciprocal trade agreements to make them truly reciprocal and equally beneficial. Some of the present agreements sound fair on the surface but the foreign countries have national laws which, regardless of the tariff rate, prohibit their manufacturers from buying U. S. machine tools if similar tools are produced in their own country. We have no such restrictions. These agreements are strictly unilateral and one-way streets. Also, measures should be taken to offset the great difference in the low wage rates paid in foreign countries and those which help support our high standard of living."

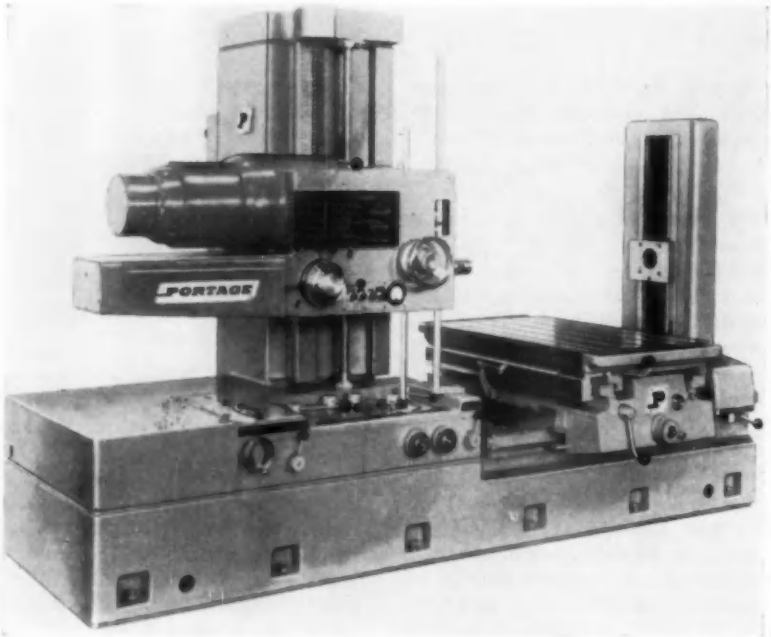
Clearing Sets Up Die Shop

Clearing Machine Corp., division of U. S. Industries, Inc., has set up a die shop in its plant at Chicago to produce large dies, largely for the automotive industries. This will be the only shop in the Chicago area specializing in large dies. Started quietly and without any public announcement, the new department already has 140 men working in two shifts and plans to increase its force to 300 in the near future. (*Turn to page* 115, *please*)

At the Chicago plant of Clearing Machine Corp. a generous amount of floor space has been allocated to the company's new die shop

NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



Portage horizontal milling, drilling and boring unit measures 10 ft, 7 in. long by 4 ft, 8 in. deep by 7 ft, 2 in. high and weighs approximately 14,500 lb

Horizontal Milling, Drilling And Boring Machine

THE Portage horizontal milling, drilling and boring machine is designed to handle work pieces of many sizes, shapes and materials. The construction and control arrangement of the three-spindle machine permits fast positioning and handling in both long or short run lots.

The feed drive for the movement of the head, table and saddle is by separate motor in the bed and is variable. The drive is by timing belt through an all speed drive unit of 10 to 1 ratio and by high-low range gear reduction of 10 to 1 ratio to provide a variable feed ratio of 100 to 1.

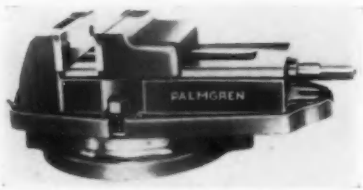
The table, with 30 in. of travel, has a work surface of 28 by 44 in. The range of saddle feed is from 30.0 to 0.03 in. per minute. *Portage Machine Co.*

Circle 68 on postcard for more data

Milling Machine Vise

THE No. 80B flanged milling machine vise with swivel base is precision built and constructed for heavy duty service for use on milling machines, shapers, planers, drill presses, radial drills and grinders.

It has flanges for clamping down to the machine table and may be used with or without the 360 degree graduated swivel base. The jaws open 8 in. and have a depth of 2½ in. *Chicago Tool and Engineering Co.*



Chicago flanged milling machine vise

Circle 69 on postcard for more data

Automatic Weld Process

INNERSHIELD, an automatic high-speed welding process and equipment, arc welds steel at speeds ranging up to 300 ipm. The process uses a flux-containing, coiled wire electrode that produces a vapor shielding for an open arc.

No fluxing or shielding agents are added to the arc from external sources, all materials are contained in the electrode. Speeds in 14 gage lap welds in the horizontal position range around 150 ipm. Lap welds in heavier material, such as 3/16 in. plate, range around 100 ipm.

Equipment for the process includes a welding head that controls electrode feed and a motor-generator power source that supplies 400 to 1000 amps welding current. The control circuit for the welding head adapts to machines and fixtures for high-volume production welding. *The Lincoln Electric Co.*

Circle 70 on postcard for more data

Die Handling Machine

A DIE handling machine for safely and quickly manipulating dies in the press room or die shop can be used either to turn over a die set or to open a set for maintenance, without danger of damaging the dies.

The wheel mounted platens, both with J.I.C. tee slots, are raised and rolled over by the powered screw lift and turnover drive in the housings.

To open a die, the top platen is raised over to simulate a press slide. A die set is placed on the other platen and shuttled into position under the top platen. The top platen is then lowered to the die and the top shoe bolted to it. This shoe is then lifted from the bottom shoe and then rolled over. To complete the die opening procedure, the bottom shoe is shuttled out, and the top platen and shoe are returned to the rails and shuttled out.

To turn a set over, the above procedure is followed, then repeated in reverse, with the bottom shoe raised, turned and lowered on the top shoe. *E. W. Bliss Co.*

Circle 71 on postcard for more data

Tool Form Grinder

AN automatic tool grinder that exactly duplicates a given form on single point brazed or solid carbide cutting tools will both rough and finish grind in the same setup, using the same grinding wheel. The machine completes both rough and finish in one automatic cycle, requiring only the manual loading and unloading of the tools.

Named the Contour-O-Matic, it is a self-contained hydraulic machine tool having duplicate fixtures for holding the work tool and a master template or master form tool. The fixture that holds the work tool against the grinding wheel follows the movement of the master template holding fixture. *United Tool Co.*

Circle 72 on postcard for more data

Dead-Weight Tester

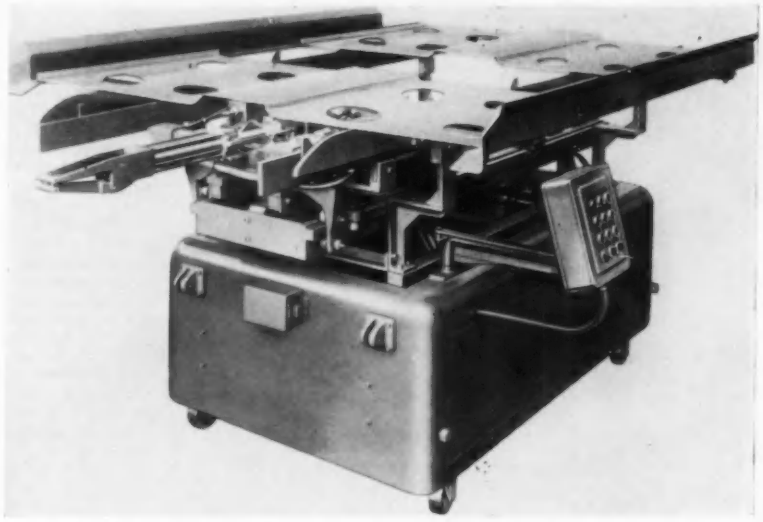
A PISTON-CYLINDER combination available for the Type 6-201 primary pressure standard extends its range to 500 psi. The type 6-201

Consolidated primary pressure standard

is a portable pneumatic dead-weight tester engineered for the calibration of pressure-measuring instruments, such as other primary standards, secondary standards and transducers. It utilizes the fundamental quantities of mass, length and time for its reference calibration.

A feature of the unit is its capacity to be used directly for calibrating absolute-type transducers and pressure instruments. In this operation, the chamber within the glass bell-jar is evacuated, thus referencing the weights essentially to zero absolute pressure rather than ambient pressure. *Consolidated Electrodynamics Corp.*

Circle 73 on postcard for more data



Die & Automation automatic press loader and transfer is portable, self-contained

Standardized Automatic Press Loader And Transfer Unit

STANDARD punch press lines can be fully automated to produce up to 18 pieces per minute through the use of Press-Matic automation units. The units load and unload parts in and out of dies in any type of punch press and will transfer parts between presses.

The machines are portable, floor-mounted, self-contained and equipped with both air and electrical connections. Electrical interlocks and builtin features prevent the press from completing a cycle if a die fails to release a part. *Die & Automation, Inc.*

Circle 74 on postcard for more data

Precision Lapping Unit

THE Spitfire 9 in. flat lapping machine, a semi-automatic bench model lapping unit, measures 13 by 18 by 10 in. The machine features a 9 in. close grained cast iron alloy lapping plate. The lapping surface is a precision ground unit, grooved both radially and spirally for maximum efficiency. Tolerances to 11.6 millionths of an inch are obtainable in volume output. The whole lapping table is supported by Timken roller bearings. *Spitfire Tool and Machine Co.*

Circle 75 on postcard for more data

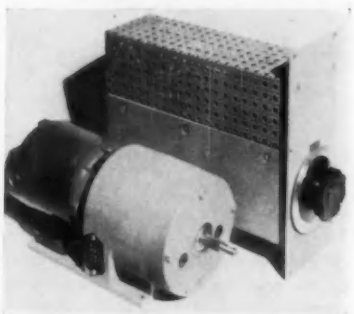
Remote Control System

THE Electrolink "60," a closed-loop remote positioner designed for industrial applications requiring fast response and high output torque is a modification of a servomechanism designed to meet rigid military environmental specifications.

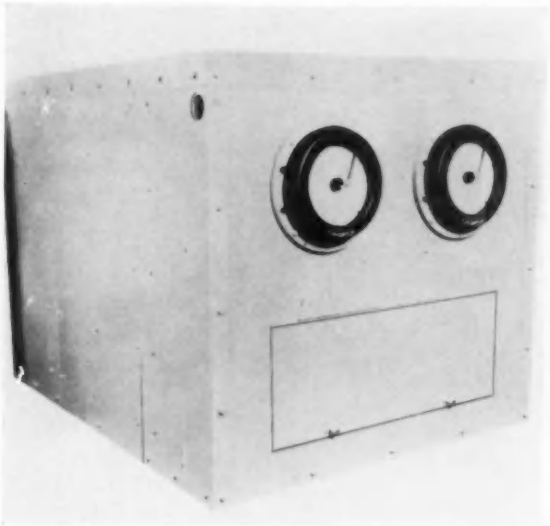
The unit consists of a combined servo-amplifier and a servo drive. The controller converts movement of a manual control into an electrical error signal. The amplifier discriminates polarity of the signal and transmits a current to one of the two clutches in the servo drive, which rotates the output shaft in the commanded direction.

The 115V, 60 cps plug-in connection and the standard mounting arrangement make it adaptable to applications such as automation of machine tools, valves, materials handling, processing, testing and missile ground handling equipment. *Lear, Inc.*

Circle 76 on postcard for more data



Lear 60 cycle remote control system



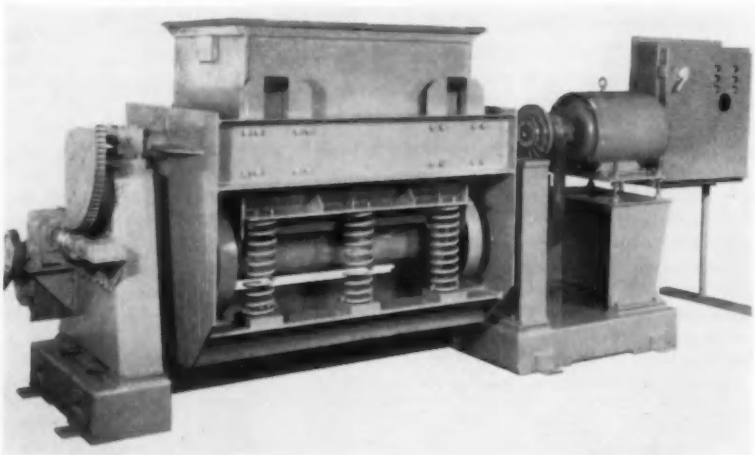
A. O. Smith multi-arc welding system developed as a dc power source to supply a multiplicity of arcs through series resistance grids. The units are compact, have silicon rectifiers and have completely weatherproof housings made of 16 gage steel. A high current dc bus bar output is provided with 4 studs, each connection rated at 800 amps. It is thermal protected against overload and is made for operation in 40 degree ambient air or less.

Multi-Arc Welding System From Single Power Source

THE A. O. Smith Corp. has developed a single power source system for multi-arc welding. The system makes use of 750 or 1500 amp, dc constant-potential power sources in conjunction with series resistant grids to accommodate arc welding, tack welding, stud welding, arc air gouging and inert arc welding.

Depending on the application, the 1500 amp set can be used where 15 to 40 arcs are required. In turn, the 750 amp unit accommodates about half the number of arcs of the larger type, again depending on the use.

Circle 77 on postcard for more data



Lord Chemical Co. Lorco Vibrator is adaptable for use in automated lines

Controlled Vibrator Speeds Up Precision Finishing

THE Lorco Vibrator uses the principle of controlled vibration and can be supplied for either fixed or variable amplitudes and frequencies. Its applications include descaling, deburring, grinding, fine finishing, coloring and burnishing of all metals and alloys, also many plastics.

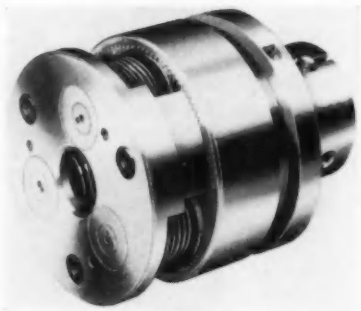
In the vibrator, every cu in. of load is in continuous work motion and a scrubbing action, caused by frequency and amplitude, is also present. In operation, a large burr on a brass part was removed in 15 minutes, 200 micro-inches of stock was removed from stainless steel turbine blades in 30 minutes, when the blades were suitably fixtured, and a heavy flash on a die cast part was removed in 23 minutes.

Models now available range from 10 to 30 hp and in bowl capacity from 6.92 to 17. 50 cu ft. *Lord Chemical Corp.*

Circle 78 on postcard for more data

Thread Rolling Heads

LANDIS thread rolling heads are made in two styles, stationary and revolving. The stationary head is designed for turret lathes, hand screw machines and automatic screw machines employing a stationary type head while the revolving head is for



Landis No 5 series thread rolling head

applications to automate screw machines utilizing a revolving type head. They can be supplied for use on threading, drilling and tapping machines. Both the stationary and the revolving heads are available in the No. 5 series having a 5/16 to ⅝ U.N.F. and 5/16 to ½ U.N.C. right range. *Landis Machine Co.*

Circle 79 on postcard for more data

Air Powered Print Unit

AN air powered printing machine applies color to depressed or sunken cavity letters and design, raised panels, faces of raised letters and design, or combinations of both.

Named the Acroprinter Model 401-A, it consists of a cast iron base with a platen type printing machine mounted at average operator feeding height. A gear and rack arrangement, powered by an air cylinder, which is mounted in the back, provides the operating power to apply printing pressure to any product that is properly positioned. *The Acromark Co.*

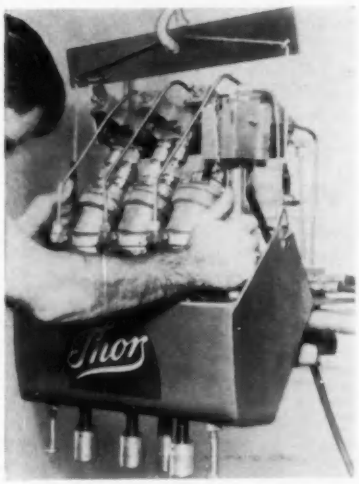
Circle 80 on postcard for more data

Hydraulic Control System

A COMPLETELY hydraulic control system designed for multiple nut-setting and other multiple power tool operations delivers uniform torque to plus or minus 1 ft-lb simultaneously to as many threaded fasteners as it is set up to drive.

Called the Thor-Draulic, the system is designed for multiple setting of as many as 20 fasteners of various sizes and bolt patterns. The machines can be balancer, torque arm, bench or machine mounted, depending upon size and application. Torque is delivered to each threaded fastener by means of two-stage hydraulic driving.

The power unit contains a hydraulic pump, driven by an electric motor. The unit occupies 2½ sq ft of floor space and stands 3 ft high and is capable of powering up to 20 spindles located within a maximum radius of 30 ft. *Thor Power Tool Co.*



Thor completely hydraulic control system

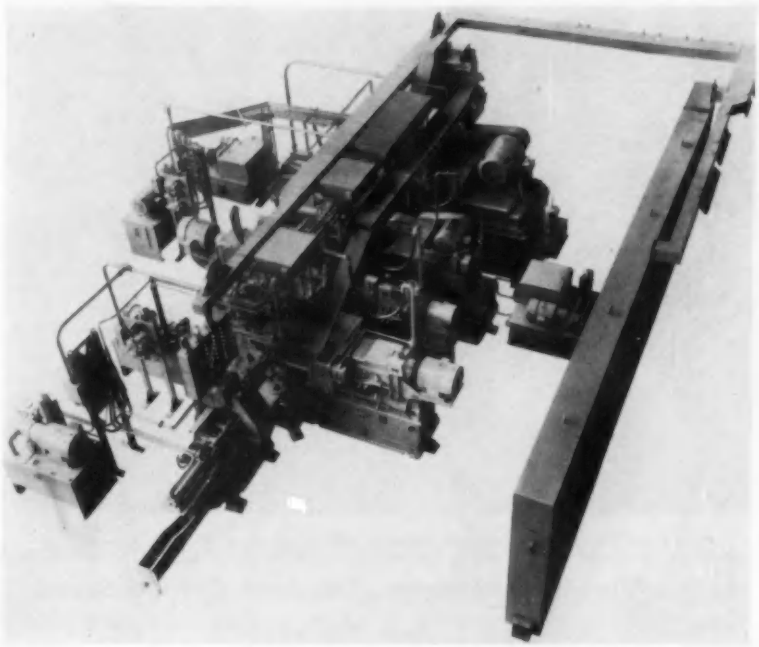
Circle 81 on postcard for more data

Nibbling Shears

COLUMN-MOUNTED electric throatless nibbling shears, designed for quick, accurate cutting, slitting and trimming, operate at 1725 cutting strokes per minute.

The throatless design permits the work to be turned in any position so that any shape may be cut on the shear. Three models are available. They are complete with a standard 30 in. column and base, which places the working table at bench height. Heavy duty 60 cycle, 115/230 v ac motors provide the power. *Beverly Shear Mfg. Co.*

Circle 82 on postcard for more data



National transfer machine performs eleven operations on main bearing caps

Transfer Machine Performs Eleven Operations

THIS transfer performs eleven operations on main bearing caps for truck engines. It has 14 stations consisting of one loading, eight working, four idle and one automatic unloading station with return conveyor. Gross production is approximately 57 clusters of bearing caps per hour. *National Automatic Tool Co., Inc.*

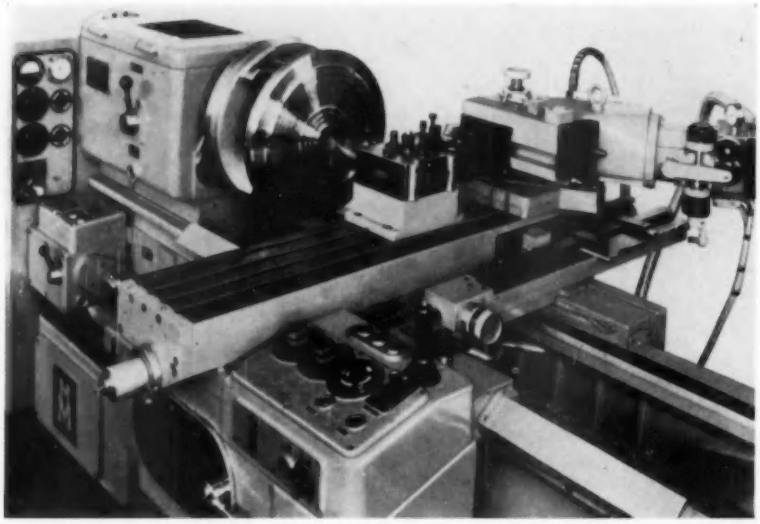
Circle 83 on postcard for more data

High Temperature Vertical Tube Atmosphere Furnace

This high temperature vertical tube atmosphere furnace is suited for numerous pilot plant or laboratory applications requiring protective atmosphere, cooling chamber and accurate stepless temperature control up to 2750 F. The furnace is a self-contained unit with all electrical components in the bottom portion and is completely pre-wired and piped. (Lindberg Engineering Co.)

Circle 84 on postcard for more data

NEW PRODUCTION and PLANT EQUIPMENT



Cosa lathe provides automatic constant cutting speed, eight speed groups

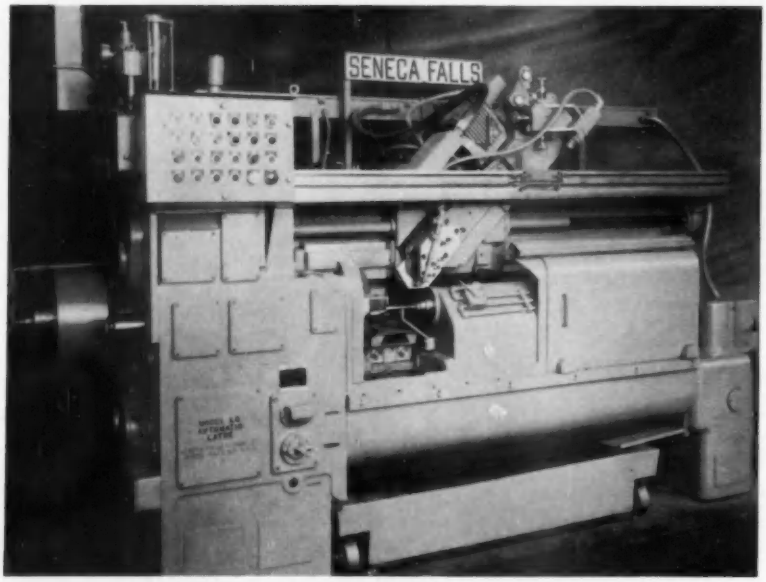
Lathe Provides Automatic, Constant Cutting Speed

SPINDLE revolutions in the Eltromatic production lathe are automatically controlled by tool travel. Constant cutting speed can be maintained, even on copy profiling jobs with varying contours. The machine retains constant metal removal within a diameter ratio of 7 to 1.

Desired cutting speed is set on a pre-selector dial. The machine includes eight 7 to 1 speed groups with cutting speeds ranging from 20 to 1800 fpm. Other features include independently feeding front and rear tool slides on the saddle, automatic feeding of upper tool slides and a special hydraulic copying device instead of a rear upper slide. *Cosa Corp.*

Circle 85 on postcard for more data

Automatic Lathe Combines Rough and Finish Operations



Automatic Q Model tracer lathes designed for high level performance in rough and finish turning shafts combine multiple tooling for rapid stock removal and single tool tracer turning for accurate finishing operations. (Seneca Falls Machine Co.)

Circle 86 on postcard for more data

Spray Equipment

SPRAY equipment for cooling and lubricating forming and cutting tools for metal and plastics is designed to supply a fine mist of coolant liquids or light cutting oil at the point of contact between the tool and the material. Called the Multi-Mister, the equipment operates from the main air line and does not require regulators. It can be quickly attached to lathes, mills, screw machines, drill presses, power saws, internal and external grinders, jig borers and machines not designed to work wet.

The equipment consists of one or more adjustable tip spray nozzles and brackets for mounting, wear-resistant flexible tubing to carry air and coolant to each nozzle, and supply tank equipped with suction tube, strainer and header to which the tubing is attached. *The DeVilbiss Co.*

Circle 87 on postcard for more data

Tempered Air Gas Burners

THREE sizes of "tempered-air" gas burners for optional use of excess

Eclipse gas burners employ excess air

air to provide wide range of temperature and atmosphere control in furnaces and ovens have applications in the production of oxidizing atmospheres, cycle annealing, and low-temperature, high-velocity heating. Burner inputs range up to 1½ million Btu per hour.

Typical applications include drying of paint and ceramics and control of temperatures in furnaces used for different operations such as hardening and drawing, where excess air is used for lowering the temperature to drawing operation. *Eclipse Fuel Engineering Co.*

Circle 88 on postcard for more data

Dial Index Feed

THIS dial index feed is equipped with a choice of 12 or 15 in. table diameters and has provisions for either 10 or 12 stations. Positive and accurate indexing is accomplished

Benchmaster dial index feed

with a 6½ in. diameter indexing gear, vee notched in its periphery. Notches are engaged by a rounded section, spring-loaded pawl operating on a rocker. The pawl takes up for wear and removes play, insuring an accurate repeat on the indexing motion.

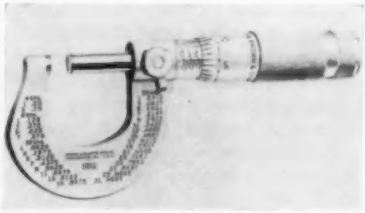
With 12 stations, the table comes to a complete dwell during a 220 degree rotation of the press crankshaft, allowing time for punch engagement and withdrawal before cycling to the next station. *Benchmaster Mfg. Co.*

Circle 89 on postcard for more data

Thimble Micrometer

THIS "finger tip" control convertible micrometer can be used either as a friction or fixed type. Used conventionally, the user depends on sense of feel; used as a friction type, a slight rotation of the nut friction control provides a uniform measuring pressure.

Graduations on the barrel are at an oblique angle, providing positive



Brown & Sharpe thimble micrometer

reading, regardless of thimble position. The one-piece stainless steel spindle and screw have hardened and ground threads and carbide measuring faces. The micrometer, with a range of 0 to 1 inch, is graduated in ten-thousandths of an inch. *Brown & Sharpe Mfg. Co.*

Circle 90 on postcard for more data

Block Type Stack Angles

BLOCK type stack angles designed to provide flexibility in setup applications are available with machined ground or scraped finish. Made of close grained cast iron, they can be stacked with bore face plates on the same vertical plane, or with one section offset to meet the requirements of the setup. *Machine Products Corp.*

Circle 91 on postcard for more data

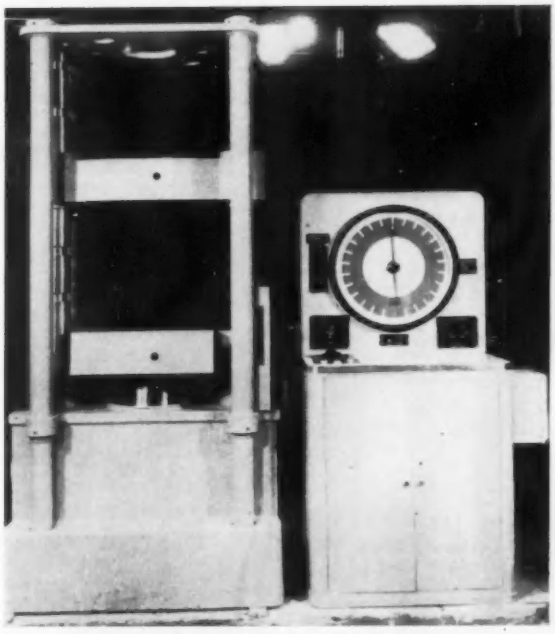
Special Boring Quills

A LINE of special boring quills uses throw-away carbide inserts, and each quill is designed to combine operations, such as: boring, facing, spotfacing, counter-boring, and turning.

The outside-cutting inserts can be adjusted both radially and axially. Close tolerances can be held for each cut individually and for the interrelationships between cuts. *Wesson Co.*

Circle 92 on postcard for more data

Mechanical Testing Unit Features Ball And Screw Design



Baldwin 150,000 lb testing machine. Testing setup consists of testing machine and control stand which incorporates the load indicator. The straining assembly is built as a separate unit from the load indicator and control console to provide flexibility of installation. This is a floor mounted machine that provides a standard working space of 30 in. between columns, by 48 in. high.

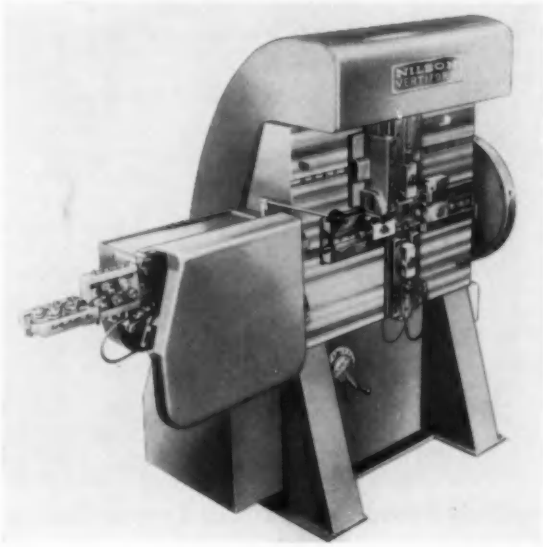
A 150,000 lb universal testing machine provides facilities for both standard testing and alternating load work. The machine can test practically any material or part which is subjected to sustained or alternating loads and strains, such as parts used in aircraft, vehicles and industrial machinery.

The machine incorporates a single pre-loaded ball and screw mechanism for feed movement. Drive power is supplied by a five-hp electronically controlled ac motor. Standard testing space is 30 in. wide with a vertical opening of 48 in.

Load is measured by two SR-4 load cells which transmit signals to the load indicator. The cells are mounted as part of the load sensitive column structure and respond to both tension and compression. The load sensitive columns are fastened to the machine base with locknuts to eliminate backlash in the mounting. The electrical signals of both cells are summed up and sent directly to the load indicator. *Baldwin-Lima-Hamilton Corp.*

Circle 93 on postcard for more data

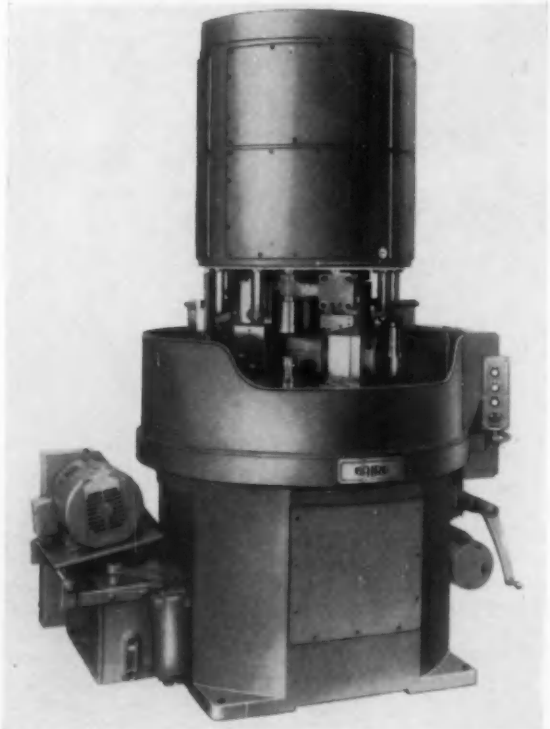
Vertical 4-Slide Forming Machine



A vertical 4-slide forming machine, the V-187 Veriform is basically an automatic 4-slide machine with the forming done in a vertical plane. It incorporates a drive shaft located behind the face of the machine. Forming slide rolls have needle bearings and are placed in the center of the slides to give a centralized thrust from low-angle bearing cams, mounted in the frame to eliminate shaft spring. (A. H. Nilson Machine Co.)

Circle 94 on postcard for more data

Eight Inch 4-Spindle Vertical Continuous Lathe



Baird eight inch 4 spindle vertical continuous lathe. Full safety interlock is provided in the dead sector for manual load and unload. Automatic load and unload can be included. It is designed and built to American machine tool standards and to maintain close tolerances in production line operations. Each spindle has precision automatic work - holding with two vertical and one cross slide tool motions in any required combination.

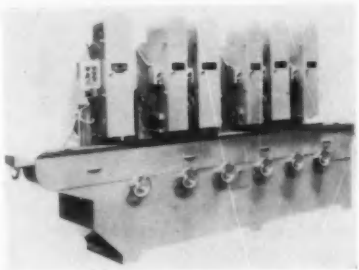
ALL four spindles of the Baird vertical, continuous lathe perform the same operations and are continuously in operation. Each spindle, in turn, becomes dead and releases the work as it passes through the load and unload sector.

Power to spindles and tools comes from a single central column which is readily accessible for installation, changeover or servicing of cams and gearing. *The Baird Machine Co.*

Circle 95 on postcard for more data

Abrasive Belt Machine

SIX grinding operations in a single conveyorized pass are possible with this conveyor-type abrasive belt machine, Model 680-6. Designed for high-volume flat surfacing of ferrous and non-ferrous metals, glass, plastics and ceramics, it is equipped with six individually-adjustable grinding heads. By using a series of progressively finer grit abrasive belts, unmachined parts can be rough-ground,



Engelberg Huller conveyor type grinder

precision-sized and machined to a fine, micro-inch finish in one continuous operation.

For parts requiring rapid but heavy stock removal, identical belts can be used on each grinding head to multiply production rates. *Engelberg Huller Co.*

Circle 96 on postcard for more data

Air Gage Meter

THE Federal Dimensionair air gage meter with remote pressure regulating and filtering consists of two separate units, an air meter in a compact housing and a regulator-filter assembly. Since it incorporates a fixed magnification system, the filtering and regulating elements of the gage are not called upon to perform the added function of setting gage modification. This enables these elements to be separated physically from the metering portion of the gage, with one regulator filter serving up to five meter units. Meter units are connected to the centrally located regulator by a five ft hose rather than by piping. *Federal Products Corp.*

Circle 97 on postcard for more data

Free INFORMATION SERVICE

Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.

USE THIS POSTCARD

FREE LITERATURE

Aircraft Steels 1

The 1958 revised edition of Aircraft Steels and Specifications provides condensed information on Army, Navy and Government specifications. This 70 page booklet is for use as a guide when specifying aircraft quality steels. *Joseph T. Ryerson & Son, Inc.*

Retaining Rings 2

A fully illustrated 16 page catalog features the expanded line of industrial retaining rings offered by *Industrial Retaining Ring Co.*

Vibration Mountings 3

Illustrated Bulletin E6B, tells how to select the proper type and size of vibration mountings for machinery. Dimensions and prices are included. *The Korfund Co., Inc.*

Automatic Conveyors 4

Bulletin FAC-103, 4 pages, features over a dozen in-plant adaptations of a line of electroplating and anodizing conveyors. *Hanson-Van Winkle-Munning Co.*

Stressed Steel Fastener 5

Two technical bulletins containing complete engineering specications and qualification test data for the Waldes QAF quick-action stressed panel fastener have been issued by *Waldes Kohinoor, Inc.*

Lubricant Selection 6

Volume 44, number 2, 28 pages, features an article entitled "Passenger Car Trends Affecting Fuels And Lubricants." It covers such topics as manufacturing and performance trends, effects on fuels and lubricants, and a summary of the progress of the automotive and petroleum industries. *The Texas Co.*

Plastic Polyurethane 7

Brochures on rigid, semi-rigid and flexible Stafoam polyurethanes used for crash pads, sun visors, sound damping in body panels, undercoating, insulation and related applications are available from *American Latex Products Corp.*

Flame-Cutting Machines 8

Form 4487, 27 pages, covers a complete line of flame-cutting machines ranging in size from small portable units to large multi-blowpipe shape-cutting machines capable of reproducing intricate patterns in steel. *Linde Co., Div. of Union Carbide Corp.*

Anti-Friction Bearings 9

Bulletin AFB-2, 23 pages, contains design requirements for anti-friction bearings of unusual shapes and sizes and current information on suitable bearing component materials for specialized operating conditions. *Industrial Tectonics, Inc.*

(Please turn page)

VOID After June 15, 1958 **4/15/58**

Circle code numbers below for Free Literature, New Plant Equipment, or New Product Information

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Friction Tester 10

The A-6 friction and wear tester used for the simulation of most types or combinations of wear, heat and atmospheric conditions that are encountered by solid lubricants is described in Bulletin SL-120. *Hohman Plating and Mfg. Co.*

Flash-Butt Welding 11

A 16 page bulletin describes the flash-butt welding process and outlines and illustrates types of clamping and flash and upset mechanisms. *The Taylor-Winfield Corp.*

Stainless Steel Tubing 12

Technical data card 148A summarizes hot working, annealing, welding and forming data on 24 of the widest used austenitic and hardenable and non-hardenable ferritic stainless tubing steels. *The Babcock & Wilcox Co.*

Spiral Point Drill 13

Publication No. M-2019-C, a paper presented during the Technical Activities Seminar held by The Cincinnati Milling Machine Co., covers the design, development and application of the spiral point drill. *The Cincinnati Milling Machine Co.*

Steel Lockers 14

Catalog B-60 covers a line of steel storage lockers. Twelve styles are presented and tables are used to show the sizes available. *Penco Metal Products Div., Alan Wood Steel Co.*

USE THIS POSTCARD

Industrial Hydraulic Oils 15

A 44 page revision of Bulletin B-4, "Hydraulic Fundamentals and Industrial Hydraulic Oils" offers an introduction to the principles of hydraulic systems, with explanations of the most important types of valves, pumps, motors, torque converters and accessories. *Sun Oil Co.*

Hand Hoists 16

The complete line of Wright Safeway hand hoists, available in 17 different lifting capacities from ½ to 50 tons, described in eight page Bulletin DH-164-C. *Wright Hoist Div., American Chain & Cable Co.*

Numerical Drill Control 17

A brochure describing the Digimatic control system for table positioning, including specifications on its three operating systems is being offered by *Electronic Control Systems Div., Stromberg-Carlson Co.*

Tracer Control System 18

The Monarch-Keller tracer control system, designed for turning, facing and boring of irregular contours, is fully explained in 20 page Bulletin 2402. *The Monarch Machine Tool Co.*

Vibration, Shock Mounts 19

Bulletin F1A, four pages, describing engineered vibration and shock mounting systems for airborne electronic equipment and other applications is available from *Federal Shock Mount Corp.*

Weld Tube Mills 20

The use of modern tube mills in the manufacture of pipe and tube is described in detail in the 64 page handbook "Electric Resistance Weld Tube Mills" published by the *Yoder Co.*

Titanium Data 21

"Commercially Pure Titanium," an eight page brochure describing the properties and corrosion resistance of pure titanium, has been published by *Mallory-Sharon Metals Corp.*

Missile Couplings 22

A 26 page catalog lists special, quick-connect and quick-disconnect couplings for use in guided missiles and aircraft. *Snap-Tite, Inc.*

Diesel Engines 23

Two Diesel engines, Models D-344 and D-516, additions to a power unit line, are explained and illustrated in detail in Bulletin BU-413, 16 pages. *Allis-Chalmers Mfg. Co.*

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FIRST CLASS
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How Ford packs reliable power into a small space

Most models of Ford Tractors are equipped with a hydraulic piston pump to raise and lower implements and provide accessory power. The design incorporates Torrington Needle Bearings and the new Needle Thrust Bearing for compact size and reliable performance.

The gear-driven pump employs six pistons which are wobble plate actuated. The main drive shaft, on which the wobble plate is mounted, is supported by a Needle Bearing. The thrust load of the hydraulic pistons is carried by a high capacity Needle Thrust Bearing.

This is one of many automotive and farm equipment applications where Torrington Needle Bearings are being used to assure efficient anti-friction performance with maximum capacity in minimum space. See your Torrington representative about adapting their benefits to your equipment. **The Torrington Company, Torrington, Conn.—and South Bend 21, Ind.**

Cross section shows how a Torrington Needle Bearing and a Needle Thrust Bearing handle high radial and thrust loads in minimum space in Ford's hydraulic piston pump.

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE ROLLERS • BALL • THRUST

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Silicon Rectifier Units

Semitron silicon rectifier assemblies rated at 100, 150, 200 and 300 kw for operation from various ac power supplies are provided as regulated or unregulated equipment. They include, in a single enclosure, complete protective equipment, transformer and rectifier assembly. In addition, the units include a saturable reactor and voltage regulator.

The complete assembly is enclosed in a floor mounted sheet steel cubicle with hinged front door and removable rear panels. They are completely protected against short circuits, overloads, element failure and loss of cooling air. Removable trays contain the silicon elements with high-speed current limiting fuses in each series group of elements. *Westinghouse Electric Corp.*

Circle 100 on postcard for more data

Cork Gasket Material

Cork gasketing material used to stop seepage and leakage of liquids and gases offers the optimum combination of impermeability, conformability and chemical inertness. Called Uniphase, the main feature is its continuous phase elastomeric binder, which surrounds and imbeds the cord particles. It is resistant to fungus attack and has ozone resistance.

It seals at flange pressures as low as 100 psi. It will not crush or extrude at flange loads as high as 4000 psi. It seals at low flange pressures because the binder conforms directly to the flanged surface imperfections. *Armstrong Cork Co.*

Circle 101 on postcard for more data

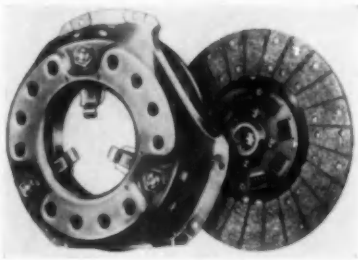
Convertible Top Material

Fade-resistant top material for convertibles made from versatile Geon polyvinyl lengthens the life of the top and retains good flexibility. Geon resins disperse easily in the formulation. Applied in a knife-coating process, the formulation has good coating characteristics. As well as protecting the fabric, it is available in a wide range of colors. *B. F. Goodrich Chemical Co.*

Circle 102 on postcard for more data

Heavy Duty Clutches

Direct pressure, heavy duty clutches for truck, tractor, bus and industrial uses are rated for engines up to and including 300 ft-lb gross torque. The dry disc, 12 in. single plate unit has a facing area of 155.4 sq in. with a unit pressure up to 27.8 lb psi. Maximum release bearing load is 464 lb, at full release. *Lipe-Rollway Corp.*



Circle 103 on postcard for more data

Automation Cylinders

A line of heavy duty air and hydraulic cylinders is said to be suited for application on machine tools, presses, welding machinery, conveyors and dies. Pressure ratings are 200 psi for air and 1000 psi for hydraulic. They are offered in nine sizes and five mounting styles. All models are available non-cushioned, cushioned blind end, cushioned rod end or cushioned both ends. Mounting dimensions of cushioned and non-cushioned cylinders are identical. *The S-P Mfg. Corp.*

Circle 104 on postcard for more data

Circuit Connector

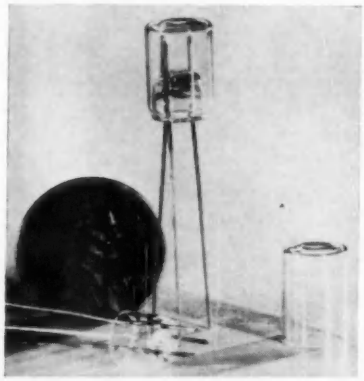
The design of a printed circuit connector makes it possible for it to accept circuit boards varying in thickness from 1/16 to ⅛ in. Spring grip action is positive over the entire printed circuit contact area. Self-alignment of the bellows-action contacts

also allows for any residual warpage of the board. A molding of glass reinforced Plaskon Alkyd 446 is supplied with stainless steel mounting bushings which allow for self-alignment. Fifteen contacts have solder lug terminations for #20 AWG wire. *DeJur-Amsco Corp.*

Circle 105 on postcard for more data

Glass Transistor Case

Production of a two-piece, all-glass transistor enclosure is by a close-control electric sealing process. The base and envelope are hermetically sealed at 1000 C while temperature near the semiconductor is kept below 150 C. Sealing is done in approxi-



mately 10 seconds. Both base and envelope of the 200 mil lead circle-enclosure are made of thin-walled precision glass. *Corning Glass Works.*

Circle 106 on postcard for more data

Spray Fixative

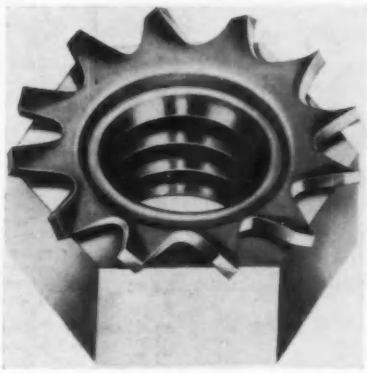
A spray fixative that allows lines to be added over treated areas and that permits easy erasure, re-pencilling or re-inking is available in 12 oz aerosol containers.

The spray protects both pencil and ink lines against smudging on drawing films and is effective on natural or transparentized tracing papers, on all types of tracing cloth, and as a fixative in illustration work involving charcoal or pastels.

A light mist is sufficient to provide lasting protection. Regardless of the amount used, pencil or ink lines can be added at will and even large areas can be erased and re-drawn if the need for change arises. *Keuffel & Esser Co.*

Circle 107 on postcard for more data

Fastener Devices

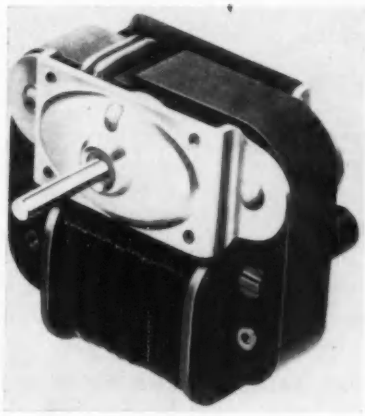


Pre-assembled nuts and lock washers have been developed with a standard #4 across-flats dimension of ¼ in. These small Keps eliminate hand assembly and lost or omitted parts. (Shakeproof Div. Illinois Tool Works)

Circle 108 on postcard for more data

Precision A-C Motor

Stack thicknesses of 9/16 and 15/16 in. and shaft diameters of ⅛ and



5/32 in. are available on a line of precision-made ac motors. Alignable bearings, large oil reservoirs with optional auxiliary oil cups, high starting torque and low noise level are featured. Horsepower ratings are up to 150. *Barber-Colman Co.*

Circle 109 on postcard for more data

Flange-Type Collar

A flange-type collar for use with Huckbolt fasteners named the 3LC permits use in oversize hole applications. The flange eliminates any tendency to overswage during installation and prevents crushing, extruding or deforming of the surfaces being joined.

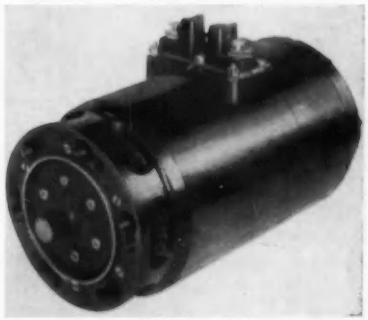
It is available in 1601 aluminum alloy, 6061, 6061-T67 aluminum alloy or C1006 mild steel. *Huck Mfg. Co*

Circle 110 on postcard for more data

Starter-Generators

A line of dc starter-generators having various applications in military, commercial and personal aircraft which are powered by small turbojet and turbo-shaft engines features the advantages of space and weight savings. A secondary use can be found in ground power units.

The machines are designed to start from nickel-cadmium, silver-zinc or

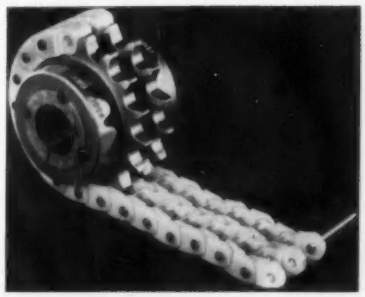


other high-performance batteries and can be furnished with or without series-start windings. *Jack & Heintz, Inc.*

Circle 111 on postcard for more data

Flexible Nylon Coupling

The chain element of a lubrication-free, corrosion-resistant nylon coup-



ling is made of nylon segments and stainless steel pins. It can be disassembled or connected at any link without special tools, and fits standard, stock steel roller chain sprockets. The coupling handles loads from zero to 40 hp and speeds from 500 to 5000 rpm. *Morse Chain Co.*

Circle 112 on postcard for more data

• • INDUSTRY STATISTICS • •

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending		Year to Date	
	March 29	March 22	1958	1957
PASSENGER CAR PRODUCTION				
Rambler	3,010	2,706	40,588	24,702*
Total—American Motors Corp.	3,010	2,706	40,588	24,702*
Chrysler	1,352	1,267	15,378	39,470
De Soto	1,385	381	10,856	43,738
Dodge	2,693	2,549	25,557	84,696
Imperial	455	451	4,637	12,186
Plymouth	8,732	8,566	99,789	190,166
Total—Chrysler Corp.	14,617	13,214	156,219	370,258
Edsel	373	390	4,058	
Ford	25,213	14,417	285,699	428,934
Lincoln	515	695	9,552	14,572
Mercury	3,886	3,492	35,003	101,322
Total—Ford Motor Company	29,987	18,994	334,312	544,828
Buick	4,693	4,649	81,203	148,232
Cadillac	2,573	3,215	38,406	42,684
Chevrolet	27,179	24,936	388,977	403,952
Oldsmobile	6,440	6,600	102,325	130,376
Pontiac	4,143	4,756	75,112	114,566
Total—General Motors Corp.	45,028	44,155	686,023	831,810
Packard	77	97	1,103	3,901
Studebaker	1,173	1,426	8,273	15,312
Total—Studebaker-Packard Corp.	1,250	1,523	9,376	19,213
Checker Cab	93	92	965	1,050
Total—Passenger Cars	93,965	80,684	1,227,483	1,791,661
TRUCK AND BUS PRODUCTION				
Chevrolet	5,968	5,949	73,688	93,009
G. M. C.	1,296	1,412	16,294	19,552
Diamond T	108	109	1,379	1,048
Divco	60	60	744	1,005
Dodge and Fargo	1,133	587	13,193	22,569
Ford	4,588	3,724	59,316	84,109
F. W. D.	28	40	342	296
International	1,791	2,050	27,634	22,372
Mack	378	247	3,715	4,637
Studebaker	246	260	2,948	3,160
White	373	349	4,734	5,151
Willys	1,751	1,059	19,914	20,818
Other Trucks	65	65	780	1,151
Total—Trucks	17,785	15,911	224,683	278,877
Buses	75	105	1,004	1,007
Total—Motor Vehicles	111,825	96,700	1,453,170	2,071,745

* Includes Hudson and Nash.

1958 TRUCK TRAILER SHIPMENTS

Industry Division, Bureau of the Census

Type of Trailer	January, 1958		
	Production	Shipments	
		Units	Value (000)
Vans			
Insulated and refrigerated	209	213	$ 1,662
Steel	31	36	235
Aluminum	178	177	1,427
Semi-insulated	71	67	406
Steel / Aluminum	71	67	406
Furniture	109	106	470
Steel / Aluminum	109	106	470
All other closed-top	1,107	1,343	7,278
Steel	496	641	3,238
Aluminum	611	702	4,040
Open-top	193	179	903
Steel	99	96	442
Aluminum	94	83	461
Total—Vans	1,689	1,908	$10,719
Tanks			
Non-and low pressure			
Petroleum			
Carbon and alloy steel	175	160	$ 1,188
Stainless steel	33	27	320
Aluminum	106	103	969
Total—Petroleum	314	290	$ 2,477
Chemical, food, fluid solids	48	38	$ 364
All other, incl. aircraft refuelers	10	10	80
High pressure (LPG, chemicals, etc.)	29	27	281
Total—Tanks	401	365	$ 3,202
Pole, pipe and logging			
Single axle	20	21	$ 28
Tandem axle	40	29	80
Total	60	50	$ 108
Platforms			
Racks, livestock and stake	124	121	$ 502
Grain bodies, all types	22	45	154
Platforms (flats), all types	436	385	1,376
Total—Platforms	582	551	$ 2,032
Low-bed heavy haulers	158	143	$ 682
Dump trailers	85	88	446
All other trailers	186	196	806
Total—Complete Trailers	3,161	3,301	$17,963
Trailer chassis[1]	286	286	$ 732
Detachable trailer van bodies[1]	481	480	1,704
Total—Trailers, Chassis and Van Bodies	3,928	4,067	$20,399

[1] Sold separately.

REGIONAL SALES OF NEW PASSENGER CARS

Zone	Region	January 1958	December 1957	January 1957	Per Cent Change: January over December	Per Cent Change: January over January 1957
1	New England	17,428	19,247	19,566	− 9.45	−10.93
2	Middle Atlantic	71,403	88,417	64,894	−19.24	+10.03
3	South Atlantic	53,573	62,143	63,373	−13.79	−16.46
4	East North Central	88,425	130,023	113,295	−31.99	−21.95
5	East South Central	16,071	32,215	20,945	−50.11	−23.27
6	West North Central	34,132	46,165	38,687	−26.07	−11.77
7	West South Central	40,517	53,009	47,242	−23.57	−14.24
8	Mountain	14,052	20,670	13,800	−32.02	+ 1.83
9	Pacific	46,331	60,247	55,518	−23.10	−16.55
	Total—United States	381,932	512,136	437,320	−25.43	−12.67

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Cal., Ore., Wash.

1958 TRUCK FACTORY SALES BY G.V.W.

As reported by the Automobile Manufacturers Association

Period	6,000 lb. and less	6,001-10,000 lb.	10,001-14,000 lb.	14,001-16,000 lb.	16,001-19,500 lb.	19,501-26,000 lb.	26,001-33,000 lb.	Over 33,000 lb.	Total
January	39,182	12,106	1,281	7,911	9,953	4,378	2,742	2,224	79,777
February	35,777	10,025	1,152	7,791	7,336	4,329	2,691	1,955	71,056
Total—Two Months—1958	74,959	22,131	2,433	15,702	17,289	8,707	5,433	4,179	150,833
Total—Two Months—1957	93,702	25,380	5,688	26,399	11,392	7,548	6,796	5,979	182,884

Common words today . . .

CAST OUT-OF-ROUND PISTON RINGS

MILLION VOLT X-RAY INSPECTION

CENTRIFUGALLY CAST SLEEVES

CENTRIFUSE BRAKE DRUMS

SPECTROGRAPHIC ANALYSIS

V-TYPE ENGINE BLOCKS

CAST CRANKSHAFTS

CAST CAMSHAFTS

but not in 1908 . . .

That year, CWC poured its first castings. Through those 50 years, CWC pioneered the above advancements and dozens of others. Today, they are common words among foundries and throughout industry—CWC leads the way in casting science and production.

Campbell, Wyant and Cannon
FOUNDRY COMPANY
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MUSKEGON, MICHIGAN

SIX FOUNDRIES LOCATED IN MUSKEGON, LANSING AND SOUTH HAVEN, MICHIGAN . . . READY TO SERVE YOU!

50 YEARS OF PROGRESS
in better foundry methods
. . . in wider use of castings

CWC
founded in 1908

The BUSINESS PULSE

Declining Phase of the Recession May Be Somewhat Similar to that of 1953-54, Probably Slightly Greater in Magnitude but about the Same in Duration. Outlook for a Rebound, However, Remains Cloudy.

The business decline seems to be continuing, but with the noticeable difference that reports are no longer so uniformly negative as in previous months. The flow of bad news is now being relieved occasionally by some moderately favorable items.

One example is the widely publicized mild upturn in new orders for machine tools, but there have been others as well, some in the form of indications that declines in key industries may be moderating.

This change has been seized upon by some observers as constituting rather definite evidence that the recession is approaching its bottom. The President has taken this position, and there would seem to be a good possibility that this will strengthen his reluctance to sanction early tax reduction. Some individuals outside the Government appear to have been similarly impressed, concluding that there is now a strong indication that this recession will not be of significantly greater magnitude than that of 1953-54.

Improved Tone of Reports

Considering the fact that economic news has been almost uniformly dark during the past half year, it is understandable that the slight improvement in the tone of reports should have engendered some optimism. Yet whether the expectations so created are really justified is questionable, for there continue to be many signs of strain in the economy, and trite though it may be, there is still truth in the old proverb that "one swallow maketh not a summer."

This Survey, published for the readers of automotive magazines exclusively in AUTOMOTIVE INDUSTRIES, has been prepared by the Guaranty Trust Company of New York.

Bad news came on two major fronts last month, carrying implications that would seem to outweigh the modest gains recorded in such things as machine-tool orders. First, there was the Government's sobering report on plans for business investment in 1958. Second, there was the release by the Federal Reserve Board of survey findings which indicate that consumers are in a relatively cautious mood.

To judge from answers obtained by the Government from businessmen in a survey conducted early this year, plant and equipment expenditures will continue downward well into the second half of 1958 at least. Indications are that the annual rate of such outlays may fall as low as $30 billion sometime toward the end of this year, which would be about $4 billion less than the estimated rate for the first quarter. This would be a substantial drop by any criterion, and the prospect cannot be ignored in appraising the chances for an early stabilization of general business.

Role of Consumers Doubtful

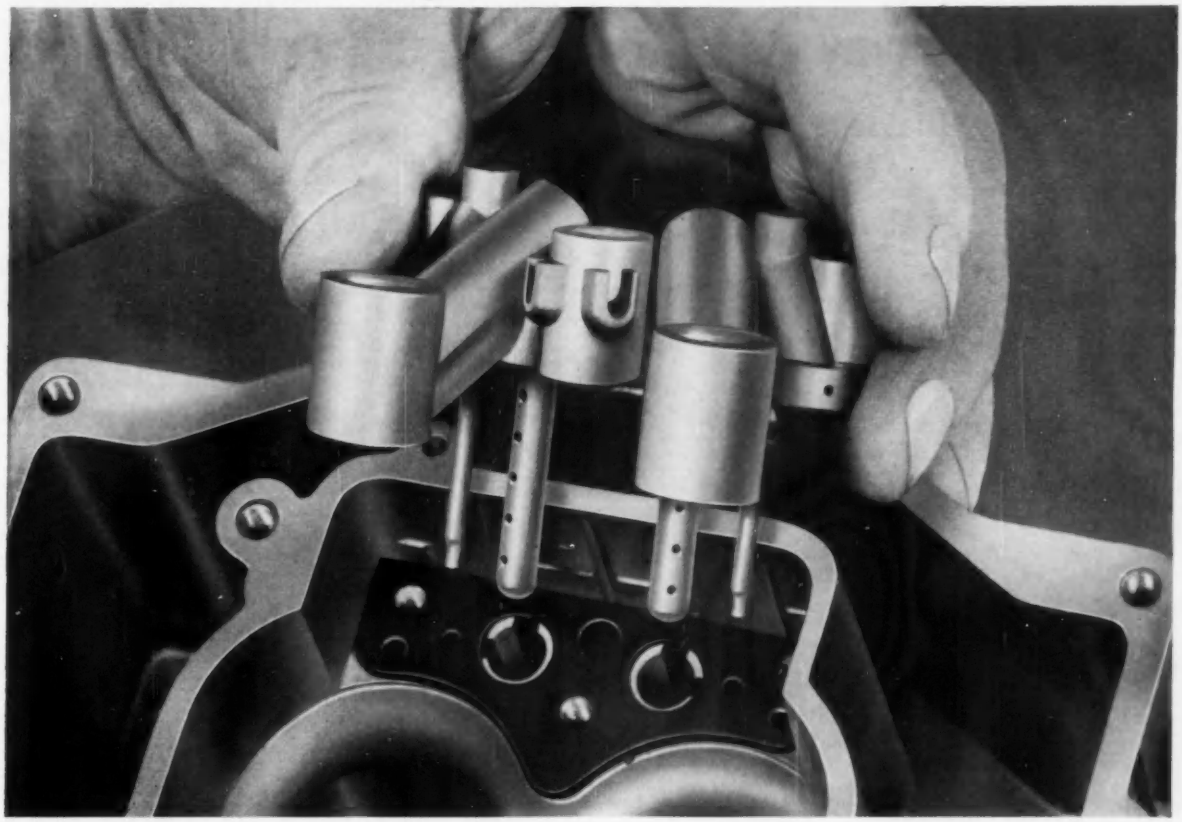
It would likewise seem doubtful that consumers can be counted upon to play a positive role in bringing about quick stabilization and subsequent recovery, to judge from a study of consumer attitudes and finances also conducted in the early part of this year by the Survey Research Center of the University of Michigan for the Federal Reserve Board. Results in this case show that consumers are much less optimistic about general economic prospects than they have been for several years and consequently are planning to spend less in 1958 on certain major durable goods, including new automobiles and homes. The percentage of persons who saw bad times ahead (some 40 per cent) was the highest reported since such surveys were first undertaken 13 years ago.

While the Federal Reserve Board cautions that the results of the study cannot be regarded as a forecast, it is at least clear that they contain no hint of impending strength in the consumer sector. Actually, the survey findings dovetail well with the present lack of buoyancy in retail trade and also with the trend of savings, which seems to be sharply upward.

Taking the average of January-February sales on a seasonally adjusted basis, consumer spending on goods ran more than 3 per cent below the peak rate of last summer, reflecting a drop in the annual rate of retail trade of between $6½ billion and $7 billion. If allowance is made for the price increases which occurred in the interim, the setback in real terms is even greater. There are no indications that this pattern changed in any significant way during March. Given the attitudes indicated by the Federal Reserve study, there would seem just as

(*Turn to page* 155, *please*)

These advantages keep Rochester America's leading carburetor . . .



PRE-CALIBRATED CLUSTERS, FEWER MOVING PARTS MEAN LONGER LIFE FOR ROCHESTER CARBURETORS!

Rochester will "GO" a long way to keep your customers happy. Nothing's ever left to chance. For example, accuracy is built-in to assure the split-second timing and metering that's so vital to today's performance. Every venturi cluster, with pressed-in idle tubes and main discharge nozzle, is pre-calibrated at the factory . . . no field adjustments necessary. And fewer moving parts mean longer, trouble-free life . . . ease of service. So be sure your cars are equipped with Rochester Carburetors . . . it's the best way to drive home a powerful performance story to your customers. Rochester Products Division of General Motors, Rochester, N. Y.

ORIGINAL EQUIPMENT ON OVER 20,000,000 FINE CARS AND TRUCKS

ROCHESTER CARBURETORS

Airslide Conveyor System at AC Spark Plug Plant

Continued from page 73

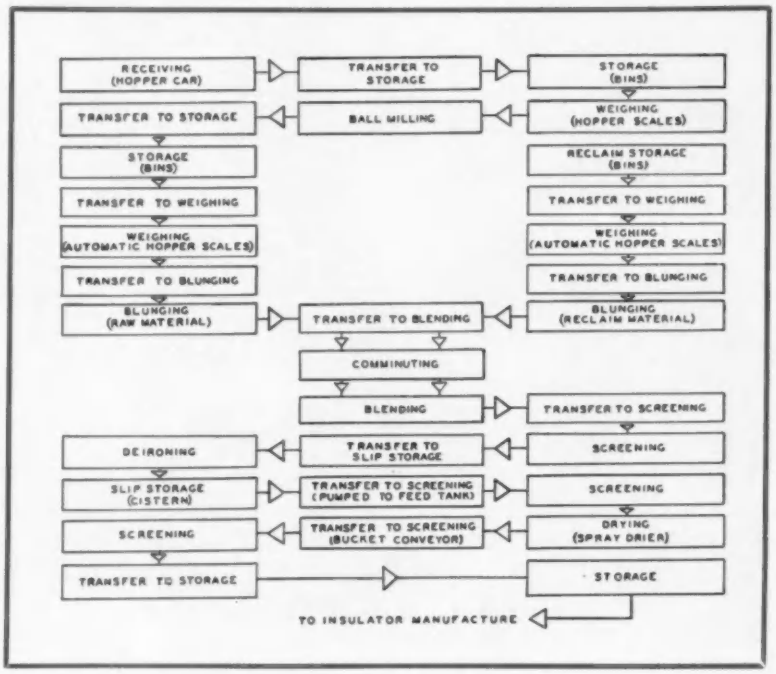
After milling, the fine powder is conveyed (again vertically and horizontally) to secondary storage bins. From these bins it is moved by gravity through a second weighing operation and then into blungers.

Here water and binders are added to produce a fluid slurry. This is then fed into a spray dryer where the water is evaporated during a 30-ft drop through the drying tower.

The resulting granular material is in the form of tiny spheres of 40 mesh size and smaller.

After a final screening operation, the spherical granules are ready for delivery to the 40 or more molding presses, where insulator blanks are formed under 4000 psi. Salvage dust from the forming operations is conveyed back to storage bins for reprocessing and reuse.

The Airslides and the two vertical lifts are manufactured for AC by the Fuller Co. of Catasauqua, Pa. AC finds its pneumatic conveyor system provides good quality control, since it is enclosed. At the same time, it offers an easy means of automatically handling the raw and processed materials for the mass production of spark plugs.



Transfer system for materials used to make spark plug insulators.

New Sun Oil Pumps Installed In Philadelphia Area Stations

Sun Oil Co. has equipped 80 per cent of its stations in the Philadelphia area with its unique Custom Blending gasoline pumps.

The new pumps are being installed throughout the company's marketing territory, following extensive consumer tests in Florida that started in February, 1956. Altogether, 8900 Sunoco service stations in 21 states and the District of Columbia, and in the Canadian provinces of Ontario and Quebec, will have the new system by mid-summer, 1958.

The new Custom Blending pump is built to provide six different octane grades of motor fuel, ranging from 94 to more than 102 octane. The grades are identified by number, starting with 200 for 100 per cent base fuel and including 210, 220, 230, 240, and 260 for higher-octane mixtures. The gain from one grade to the next is about 1½ octane, the company said.

The pump draws fuel from two separate underground tanks in exact proportions established by the dial setting. One tank contains Blue Sunoco 200, the base fuel; the other, Sunoco Octane Concentrate, a fuel on the order of 104 plus octane.

In the blending process, the two streams of fuel are fed separately through a hose-within-a-hose to the nozzle, where they are mixed. The grade number indicates the general price range as well as the type of mixture. For example, 220 will generally sell for two cents per gallon more than the base fuel and contains two pints of the octane concentrate.

The pump is capable of handling as many as nine different blends, and it automatically computes the price for the blend selected.

At present, the company said, four out of every ten motorists are paying premium prices for higher octane fuels than their cars can use to advantage; and two out of every ten are trying to operate on fuels of too low an octane quality.

The new system, according to Sun officials, allows the motorist to choose the blend that comes closest to fitting the needs of his car.

The company said that dealers are prepared to suggest the starting blend for any particular make and year of car; but, because of engine differences, it is urging car owners to experiment until they hit on the blend that gives top efficiency.

A Fundamental Part of Automotive Engineering

BURTON SPRINGS

FOR MOTOR CARS

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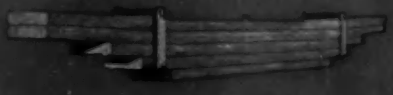
TRACTORS . . . TRAILERS

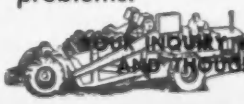
OFF HIGHWAY



Between the road and load, few major auto parts are as vital as **SPRINGS.** To a large degree, they equalize and distribute stresses and strains, soften shock, level the ride, protect the vehicle, its lading, and the pavement itself. The proper selection and design of SPRINGS is a fundamental part of automotive engineering.

Almost every prominent builder of trucks, trailers, tractors, buses, motor cars and off-highway equipment uses **BURTON** leaf and coil springs, specially engineered and specified as original components.

Burton Spring Engineers are ready to work side-by-side with your technical people toward a practical solution of your spring problems.



YOUR INQUIRY WILL RECEIVE PROMPT AND THOUGHTFUL ATTENTION

BURTON AUTO SPRING CORP.

WESTERN AVENUE AT FORTY-EIGHTH STREET • CHICAGO 32, ILLINOIS

AIR BRIEFS

By RALPH H. McCLARREN

Production of Tartar Guided Missiles

Convair Division of General Dynamics Corp. has been awarded a Navy contract in the amount of $8 million for pilot line production of the Tartar guided missile. The Tartar missile is the newest and smallest of the Navy's guided missiles in the surface-to-air category. It is designed for use from ships as small as destroyers and for secondary batteries aboard cruisers. The Tartar is a junior version of the Terrier missile built by Convair, production of which is proceeding full speed ahead. The Tartar missile is to be produced at Convair's plant in Pomona, Calif. Missiles from the pilot line production will be used for testing and evaluation at the Naval Ordnance Test Station at China Lake, Calif., and on board the USS Norton Sound, prior to going into full production.

2900 Aircraft In Flight Service

The International Air Transport Association reports that its member airlines are operating a total of 2900 aircraft in flight service during this first half of 1958. For the first time, the majority of aircraft in the fleets of IATA's 81 members are four-engined machines. The four-engined type make up 51 percent of the 2900 total aircraft.

We noted with interest that the greatest number of any one type of aircraft in use in the International fleet is the Douglas DC-3. Six hundred and ninety-four DC-3's are currently in use.

Fifty-nine different makes of aircraft and helicopters are serving with the International member companies. There are 43 helicopters in use.

Small Business Concerns To Benefit from Missile Program

According to Major General Ben I. Funk, ballistic missiles manager for Air Materiel Command, Inglewood, Calif., small business concerns in the San Fernando Valley may soon expect additional subcontracts in support of the Air Force's top priority Ballistic Missiles Program.

General Funk commented on the above in an address to the combined San Fernando Valley Chambers of Commerce when speaking before them in March, 1958. The General noted that almost 21 percent, or more than 267 million dollars, of all subcontracts let by prime contractors in the Ballistic Missiles Program have, in the past, gone to small business concerns employing 500 or less people. In commenting about the Atlas ICBM program, he stated that almost 50 percent of all monies expended on the Atlas have gone to small business subcontractors.

Utility Aircraft Shipments

Shipment of 601 one- to ten-place utility and executive aircraft by eight companies during January was reported by Joseph T. Geuting, Jr., Manager of the Utility Airplane Council, Aircraft Industries Association. The shipments included 540 planes of four-place or more, and 61 one- and two-place aircraft, with a total dollar value of $8,749,000 figured at the manufacturers' net billing price. Included in the 540 four-place or more aircraft were 87 twin-engined aircraft. Shipments by nine companies the previous month totaled 508 valued at $7,870,000.

Accurate Remote Control System for Industrial Use

Lear, Inc., Grand Rapids, Mich., has recently announced the development of "Electrolink 60," a closed-loop remote positioner designed to operate on 60-cycle ac to provide a fast response, high output torque, motor driven servomechanism of exceptional accuracy for industrial applications.

The Electrolink consists of a combined controller-amplifier and a servo drive. The output shaft provides accuracies of positioning control to better than ¼ deg. At maximum excitation, the servo output torque is 250 lb-in. The system reaches a maximum speed of operation in 0.020 second.

Jet Transport Service Facilities

For the next year there will only be about 12 major cities in the United States between which the new jet transport aircraft will be able to operate economically. Jet transport planes will be going into domestic airline service about January 1, 1959. American Airlines expects to receive the first of 30 Boeing 707's and Boeing 720's in November, 1958. It is likely the first commercial service for these jet aircraft will be between Los Angeles and New York.

(*Turn to page* 136, *please*)

"B&W extrusions simplify our production problems

We can reduce final parts cost through the use of a B&W Extrusion because it cuts machining time and eliminates waste of costly material."

Machining is expensive and wastes material. It is doubly so when it is not necessary. Design engineers should investigate the possibility of using an extruded section as starting material, particularly if expensive or difficult to machine materials such as alloy or stainless steels are involved. In many cases, by using a B&W Extrusion, parts production can be reduced to a mere cutting to length and a few simple finishing operations.

To find out more about how B&W Extrusions can help you design a better product at a lower cost call on any of the local sales offices of B&W's Tubular Products Division or write for a copy of Bulletin TB 413. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

B&W TUBULAR PRODUCTS DIVISION

TA-8027-E1

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals.

Continued from Page 39

from a maximum in tension through zero to a maximum in compression, and then reversing.

The control console consists of a programmer which controls frequency, stroke, and load during the test; and instrumentation to measure and indicate the load developed in each test cycle.

A special control console is available for supplying longer strokes at lower frequencies from 0 to 100 cycles per minute.

The first of these testing machines has been ordered by the University of Illinois for delivery later this year.

Chrysler Gets Awards Totaling $50 Million

Chrysler Corp. has received three new contracts totaling about $50 million for further production work on the Jupiter and Redstone missiles.

The bulk of the latest Army award to Chrysler is a $25,767,293 contract for missile repair parts for Jupiter and component parts for training. A second Jupiter contract calls for construction of ground support equipment.

The third contract for about $20 million covers work on the Redstone ballistic missile.

Work will be carried out in Chrysler's Warren, Mich., missiles plant, where the Jupiter and Redstone are being produced in quantity.

Atomic-Powered Winged Missile Seen as War Deterrent Weapon

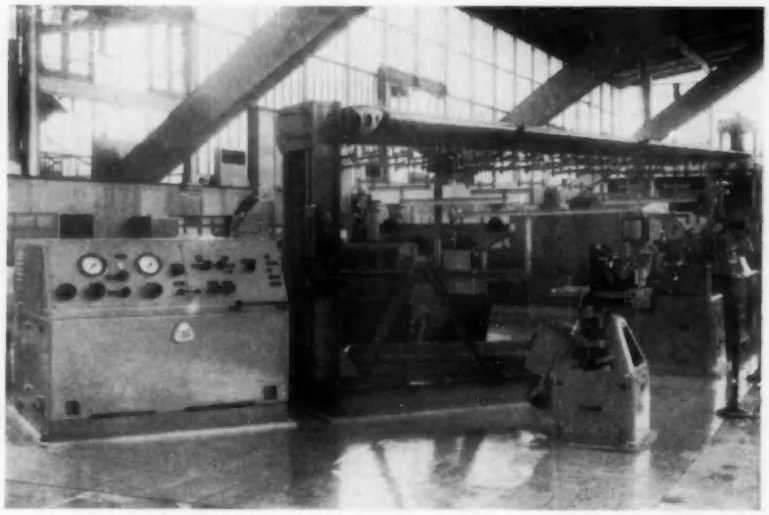
A fleet of atomic-powered winged missiles cruising endlessly at high altitudes and ready for immediate retaliation in event of attack was described recently at the Space Age Conference in Los Angeles, Calif.

Dr. William F. Ballhaus, vice-president of Northrop Aircraft, Inc., and general manager of its Notronics Div., said such missiles would have the advantage of unlimited range through the use of atomic power plants. Because there would be no crew members, the missiles would not have to return to their bases other than for periodic maintenance.

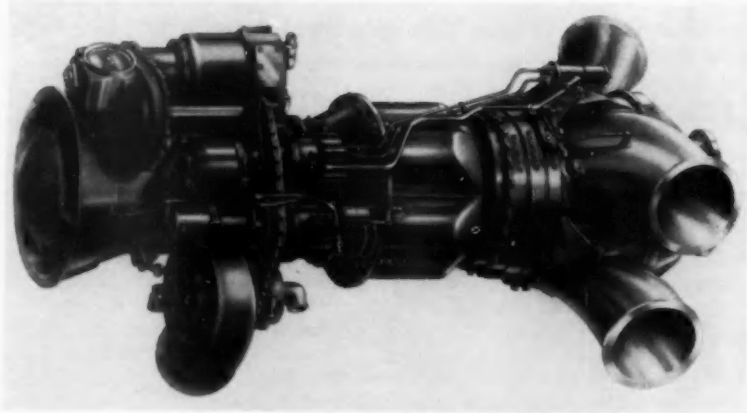
Dr. Ballhaus explained that the missiles would be guided by onboard electronic equipment which would be programmed for indefinite hovering in the upper atmosphere. A ground signal to the guidance equipment would initiate a thermonuclear attack on a preselected or designated target. Such guidance equipment is feasible at this time, he said.

The winged missile, unlike the ballistic missile, utilizes aerodynamic forces and operates within the atmosphere. Often called the "cruise" missile, it flies rather than hurtles and can carry enormous payloads.

(*Turn to page* 104, *please*)



An airplane wing is under test in Losenhausen fatigue testing device. A series of levers on the underside of wing give accurate knowledge of stress distribution.



NEW TURBINE ENGINE DESIGNED FOR HELICOPTER USE

Napier Gazelle Junior turbine engine, intended for the next generation of single- and multi-engined helicopters, is designed for mounting in any position from horizontal to vertical. Developed from the larger Gazelle, it has a sea-level rating of 920 shaft hp and weighs 495 lb. Maximum diameter is 39 in. and overall length 54 in. The axial-flow turbo-compressor, which is independent of the coaxially mounted, single-stage power turbine, drives the output shaft through epicyclic gearing.

THERE'S A NEW BABY COMING AT THOMPSON—rear suspension components that will help improve the ride of your models of the future. These are Thompson's latest developments and they come from the same Michigan Division research center that produced front wheel suspension ball joints, as well as many other chassis parts. We'll be happy to show you how you can use these new Thompson products to your advantage. Why not call Jefferson 9-5500, or write us at 34201 Van Dyke, Warren, Michigan.

You can count on TP **Thompson Products**

Michigan Division: Warren and Portland

News AUTOMOTIVE AND AVIATION

Continued from Page 102

Steel Output Hits Rock Bottom In Auto-Minded Detroit Mills

Steel output in the Detroit area hit bottom this month as the city's four steel mills, heavily dependent on the automobile industry for orders, poured at approximately 10 per cent of capacity for at least one week.

Great Lakes Steel Corp., Ford Motor Co., McLouth Steel Corp., as well as Jones & Laughlin Corp.'s stainless division, all were closed during the first part of April, with indications that some shutdowns might last a while longer.

During the week ending April 5 output dropped to 20 per cent. The following week, with all companies scheduling shutdowns at the same time, the rate fell below 10 per cent of capacity. Only during steel strike periods has the production been so low.

Great Lakes, with an annual capacity of 3.5 million ton, idled 6000 employes for two or three weeks. Ford ended its steelmaking operations for three weeks, laying off more than 200. Ford's capacity is 1.89 million ton.

McLouth sells 35 per cent of its total steel output to General Motors. Ford's output, of course, is used entirely in Ford automotive production. Great Lakes sells to all automobile companies, but also has substantial non-automotive customers.

Cleveland Group Pushing Plans For Luxury Car Called Argonaut

Apparently deaf to all talk of recession, a group of Cleveland businessmen is pushing plans for an early summer introduction of a super-luxury car that will cost more money and use more parking space than any other American automobile.

The new car, called the Argonaut, figures to be even bigger than the Cadillac 75 limousine series. The Argonaut, according to its planners, will have wheelbases of 126⅝, 148, and 154 in. The big Cadillac has a wheelbase of 149.8 and an overall length of 237.1 inches.

The Clevelanders are headed by Richard S. Luntz, who is president of the Luntz Iron & Steel Co. in Cleveland. According to Mr. Luntz, five of the six custom bodies will be built in Italy and the sixth in this country. He plans to sell about 750 cars a year. Prices will begin at $15,000.

Mechanical details of the Argonaut have been well guarded. Mr. Luntz has revealed, however, that the car will be built on a frame of 5 in. cold-drawn tubular steel. Horsepower of the V-8 engine is still under wraps, but the weight of the car and the 32-gal. gasoline capacity indicate it should be high.

The top model of the Argonaut is being named the Texan—an indication of where Mr. Luntz expects to sell more than a few of his anti-recession automobiles.

NEW ROCKET ENGINE SUPPLEMENTS FURY'S JET POWER

North American Fury, modified to accommodate a new rocket engine, is being tested at the Naval Air Test Center in Maryland. Rocket engine, the AR-1, is located just above jet tail pipe outlet. Navy says plane has made "significant" gains in altitude and speed over the Fury's normal near-sonic speed and 50,000-ft altitude.

CESSNA ADDS NEW MODEL TO 1958 LINE

All-metal Model 175, a four-place, single-engine airplane, is the newest addition to the Cessna 1958 line of business aircraft. Power plant is the six-cylinder Continental GO-300A 175-hp geared engine. The geared engine is rated at 3200 rpm using 80 octane fuel. The cowl is designed to float instead of being rigidly fastened to the airframe. Price of the 175 is $10,995 f.a.f. Wichita, Kan.

You may have met the man in the middle—

He is one of our C/R Sales Engineers. He, or one of his associates, may have been in your plant many times. Here, he's shown helping to check the installation of a C/R oil seal on a Detroit automotive assembly line—*after the seal design has been approved for production*. He wants to make absolutely certain this seal is installed correctly to assure maximum performance and service.

This personal supervision of skilled oil seal engineers and their careful attention to detail, typify every phase of research, design, production and testing of C/R Oil Seals. It accounts for the recognition C/R has earned in sealing applications. And it is a major reason why more automobiles, farm and industrial machines rely on C/R Oil Seals than on any similar sealing device.

If you have a sealing problem, critical or simple, bring it to Chicago Rawhide. C/R engineers will help you select the correct oil seal of existing types or will cooperate with you on a special design.

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C/R PRODUCTS: C/R Shaft and End Face Seals • Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

C/R OIL SEAL DIVISION

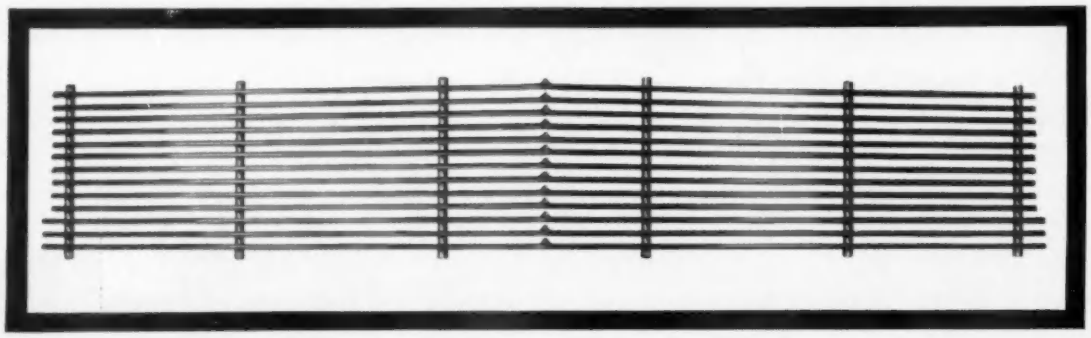
CHICAGO RAWHIDE

From
Metal Mouldings:
the appeal
of FORM

"Just looking," the prospect may say as he steps into the showroom. Then his eye lights on the silvery latticework of Alcoa® Aluminum that forms the grille. Intrigued, the prospect stoops for a closer look. Such is the preamble to sales.

Shaping the trim that helps sell cars is the 30-year specialty of Metal Mouldings Corporation, Detroit. The grille below, with its ingenious technique of assembly, demonstrates aluminum's fluid formability. Metal Mouldings also roll-forms, stamps, anodizes, bright-dips, polishes and buffs Alcoa Aluminum . . . forming this most manageable metal into a thousand different functional and ornamental trim parts.

Alcoa does not make automotive trim. But our scientists and engineers, collaborating with such imaginative fabricators as Metal Mouldings, have evolved most of the modern techniques for forming, coloring and texturing aluminum. The results of this fruitful partnership are self-evident in Detroit's latest, most glamorous products.



ALCOA ALUMINUM gives every car more GLEAM AND GO

ALUMINUM IS FORM . . . ALCOA IS ALUMINUM

Aluminum works like a matrix of the mind to give design ideas dimension. Responsive to concept, faithful to detail, flexible and unfettered as your imagination, aluminum takes more shapes more readily than any other metal. Share our intimate knowledge of this most versatile material. The way: see other side.

Aluminum Company of America

Aluminum is FORM

Cast it: Aluminum can be cast in sand, die, plaster and permanent molds. Shape is no problem; size is no problem; thinner, more uniform walls are possible. Cast in aluminum for smooth surfaces, close tolerances, high-density nonporous parts.

Coin it: Many aluminum alloys are ductile enough to permit coining of amazing detail. Fidelity of base, and no protective plating is needed. Semi-coining, a combination of embossing and coining, eliminates the labor of hand-chasing aluminum surfaces.

Draw it: Odd shapes, as well as the usual rectangles, cylinders and hemispheres, are not unusual with aluminum. Most shallow draws can be made on single-action presses, the highest speeds possible. Tooling costs are kept low; cast-iron tools can be used for short runs.

Extrude it: Complicated cross sections call for aluminum extrusions. Strength can be added where it's needed, weight greatly reduced. Die costs are moderate, tooling simplified. Welding, forming, riveting, machining and expensive assembly work are eliminated.

Impact it: Hollow, cup-shaped shells, flanged or cup-end tubes, solid shapes and combinations of these forms lend themselves to aluminum impacts. Smooth, bright scaleless surfaces, with no parting line and no draft to trim, aluminum impacts match the strength of forgings. High production speeds at lowest cost are possible because machining, fabrication and assembly are eliminated.

Forge it: Long die life, high mechanical properties, precision tolerances, zero drafts—these are some of the arguments for aluminum forgings. Larger, more intricate shapes can be forged because of the great weight savings. Thinner webs and ribs are possible. (Aluminum forgings have smoother and more uniform surfaces.)

Machine it: Aluminum can be turned at the highest speeds and feeds (to the most precise tolerances possible). Extremely fine finishes are attainable. Tools last longer. Plating is eliminated. Color matching from part to part is assured by nonfading anodic colors.

Stamp and form it: Aluminum can be stamped with standard tools and techniques, allowing for simple spring-back in forming dies. No additional tool costs are involved. Sharp, clear letters, figures and decorations are raised. Aluminum's easy machinability prolongs die life.

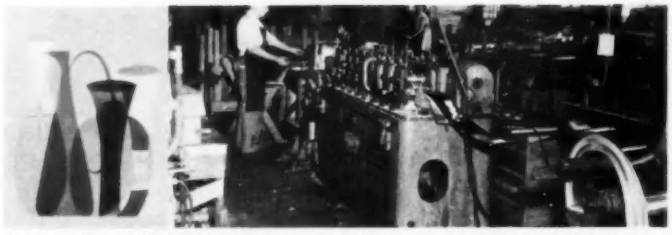
Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

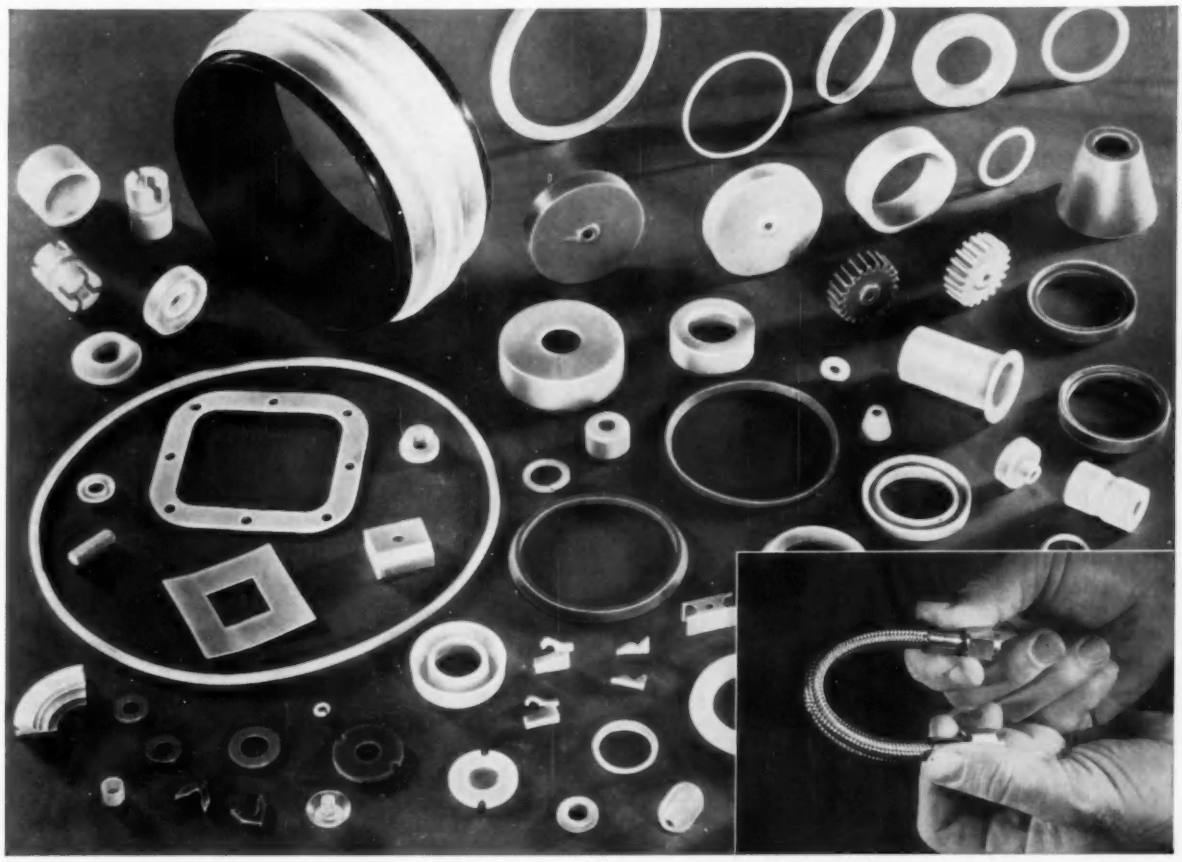
GET MORE INFORMATION ON DESIGNING IN ALUMINUM

Write for Alcoa's inspirational bibliography which describes Alcoa books and films to help you design in aluminum. Write: Aluminum Company of America, 2186 Alcoa Building, Pittsburgh 19, Pennsylvania.



Roll-Forming at Metal Mouldings Corporation, a pioneer producer of decorative aluminum. Alcoa teams up with leading fabricators like Metal Mouldings to provide you complete and unparalleled aluminum design and fabricating service. For information, write: Metal Mouldings Corporation, 14451 W. Chicago, Detroit 28, Michigan.

Bring R/M's greater experience, better facilities, to bear upon all your TEFLON* problems

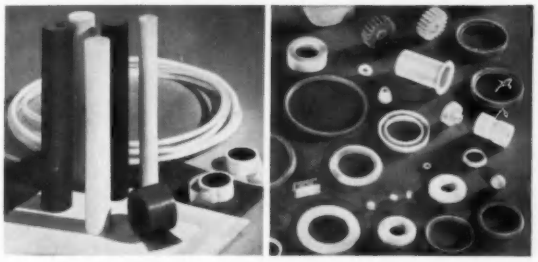


There is no substitute for the years of experience which Raybestos-Manhattan engineers have had in handling "Teflon"—nor for the unequaled plant facilities which implement this know-how. That is why we suggest that you come to R/M for *all* your "Teflon" needs.

The extruding, molding, machining, and bonding of "Teflon" is an old story at R/M. We are familiar with applications in the automotive and aircraft industries, where "Teflon" serves better than any other material, and we will be glad to fabricate parts and components to your precise specifications.

In addition, we can supply you with the other R/M "Teflon" products, such as flexible "Teflon" wire braid covered hose, "Teflon" sheets, tape, tubes, rods, and bondable "Teflon." Get in touch with your nearest R/M district office for the "Teflon" products you require and engineering information. Or write us for further information and literature.

*A Du Pont trademark



Other R/M "Teflon" products useful to your industry include centerless ground rods held to very close tolerances; stress-relieved molded rods and tubes; parts painstakingly machined to your specifications. Our mechanical grade of "Teflon"—Raylon—has many characteristics of virgin "Teflon."

RM

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PLASTIC PRODUCTS DIVISION FACTORIES: MANHEIM, PA.; PARAMOUNT, CALIF.

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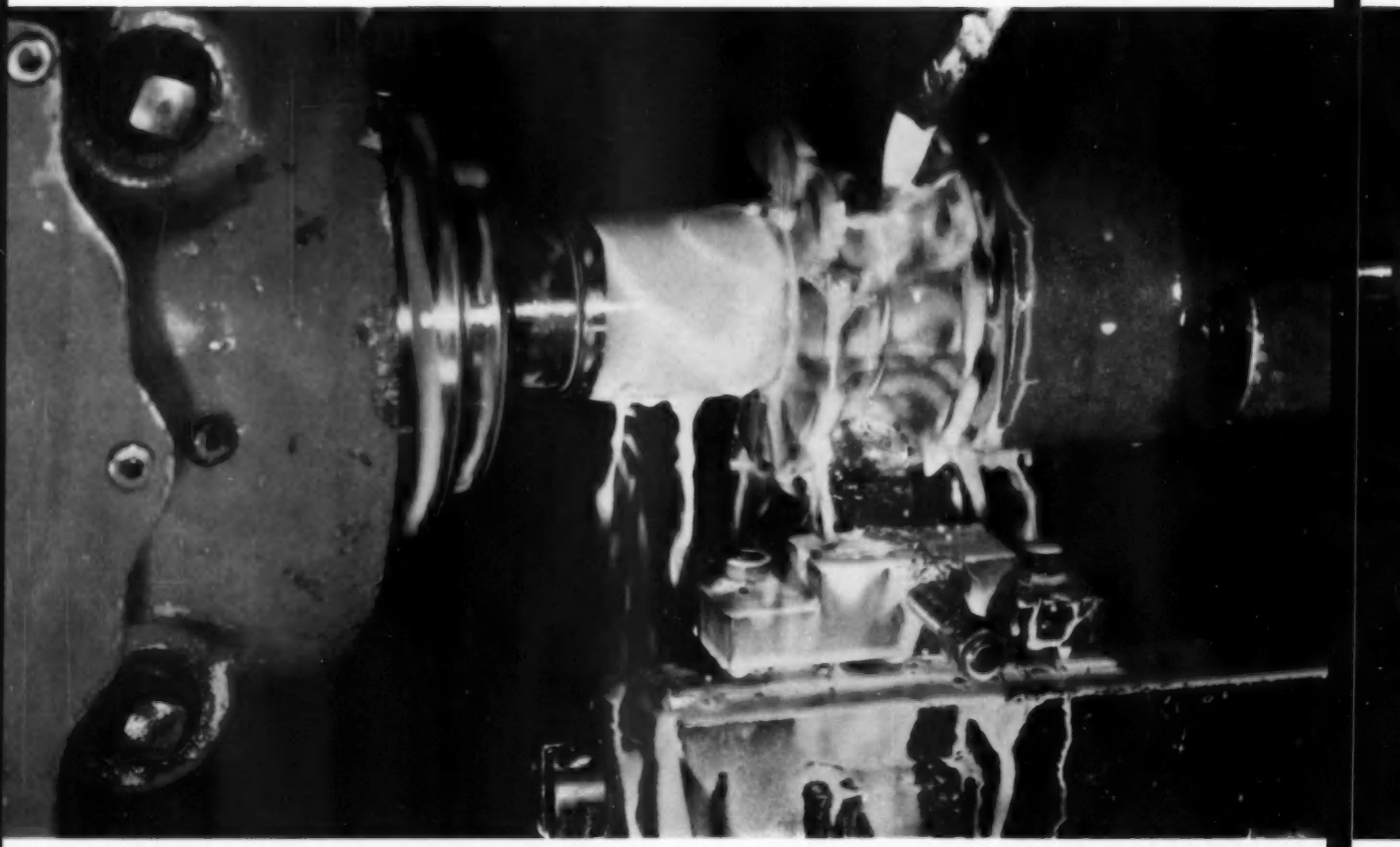
RAYBESTOS-MANHATTAN, INC., Engineered Plastics • Asbestos Textiles • Mechanical Packings • Industrial Rubber • Sintered Metal Products • Rubber Covered Equipment
Abrasive and Diamond Wheels • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Industrial Adhesives • Bowling Balls

Wheels and machines stay cleaner with emulsions of new S.E.C.O. Also, finishes are better.



Emulsions of new S.E.C.O. allow faster cuts with less tool wear.

Photos courtesy of
Peter Salmon Co., Glenside, Pa.

NEW EMULSIFYING OIL KEEPS MACHINES CLEAN, PROTECTS AGAINST RUST, GIVES IMPROVED HARD-WATER EMULSION STABILITY

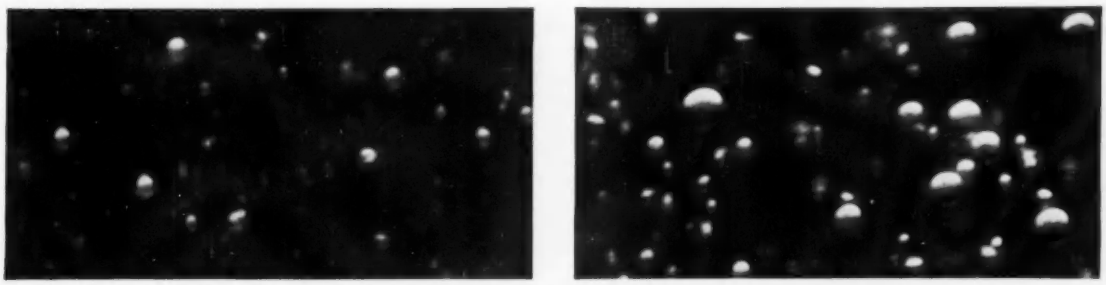
Emulsions of Sun's new S.E.C.O. (Sunoco® Emulsifying Cutting Oil) with smaller oil particle size give you the following benefits—

EMULSION STABILITY—In hard-water areas, impartial field tests show that emulsions of *new* S.E.C.O. stand up better under more severe conditions than those made with other regular emulsifying cutting oils.

DETERGENCY—The excellent wetting properties and detergency of *new* S.E.C.O. allow dirt and fines to settle quickly out of emulsions. Grinding wheels and machines stay cleaner.

RUST-PREVENTION—The smaller oil particle size in emulsions of *new* S.E.C.O. gives better metal wetting properties and increased protection against rust and corrosion. See photos below.

If you're a regular user of S.E.C.O., notice how much it has been improved. If you're not, find out what we mean about greater economy and improved production with *new* Sunoco Emulsifying Cutting Oil. Call your Sun representative, or write to Sun Oil Company, Philadelphia 3, Pa., Dept. I-9.



800x photomicrographs of 10% emulsions. *New* S.E.C.O. emulsion on left contains *8 times* as many oil particles per unit volume as ordinary emulsion on right. Many minute particles in S.E.C.O. emulsion do not show at this magnification.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

©Sun Oil Co., 1958

Tru-Stop Brakes

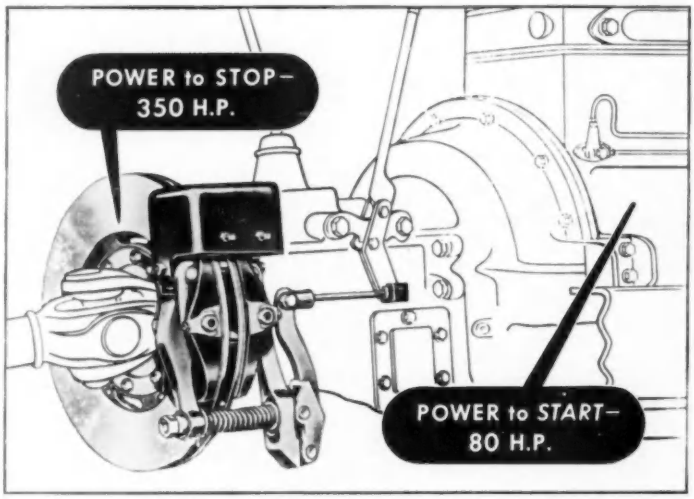
Meet Every Heavy-Duty Safety Requirement

OFFER POSITIVE PROTECTION AGAINST RUNAWAY OR PARKING ACCIDENTS—AT LOWEST COST

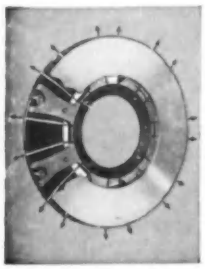
HERE IS WHY:

They have surplus power required for emergency service—no dangerous self-energizing

TRU-STOP Heavy-Duty Emergency Brakes are not only excellent parking brakes. They serve as a complete, independent and fully reliable braking system. Operating on the propeller shaft they enable the driver to continue on safely in the event of service brake failure. TRU-STOP brakes have the surplus braking capacity to be used *repeatedly* as an auxiliary to service brakes.

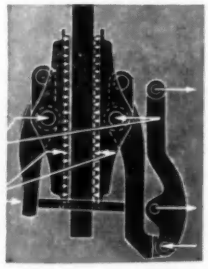


Brakes actually do more work than the engine in terms of horsepower Where it takes 80 HP to accelerate to 20 miles per hour, it takes 350 HP to make a safe stop from 20 miles per hour within required limits



Ventilated to throw off heat

Brake efficiency depends on ability to throw off intense heat —rapidly. Discs of TRU-STOP brakes are exposed to the air even during the braking operation. Ventilated design circulates air *between* the disc plates.



Give uniform brake pressure

Disc of TRU-STOP brakes is "squeezed" between the flat surface of the shoes. Effort applied to brake lever operates front and rear lever arms simultaneously. Pressure is exerted on the center of each shoe. Entire lining surface is in contact.

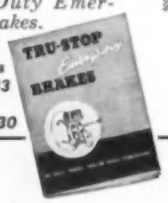
FOR SAFE, ECONOMICAL, HEAVY-DUTY BRAKING WITH MAXIMUM LIFE AND MINIMUM MAINTENANCE

TRU-STOP Brakes are used on a great variety of mobile and stationary equipment

SUCH AS—

- Motor cranes
- Road rollers
- Dump trucks
- Power dividers
- Cooling tower fans
- Oil well pumps
- Cold header presses
- Scrubbing machines
- Wire rope stranders
- Fork lift trucks
- Motor scrapers
- Tractors
- Graders
- Diamond core drills
- Electric locomotives
- Oil well servicing rigs
- Railway inspection cars
- Shapers
- Power take-offs
- Winches
- Motor shovels
- Tractor loaders
- Conveyors
- Hard rock drill positioners
- Mine locomotives
- Power presses
- Railway power ballisters
- Cable tool spudders
- Aerial tram cars
- Tension wire stringers

We will be glad to answer any questions or give you more detailed information about TRU-STOP Heavy Duty Emergency Brakes. Send for Catalogs DH-33 and DH-530



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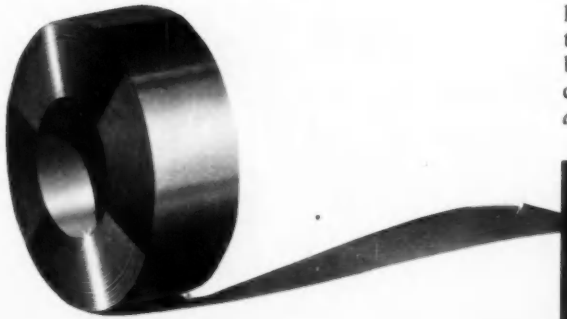
TRADE MARK

no chipping - no rusting
no pitting - no peeling

no work-no worry

with ever-bright brightwork of

Superior stainless steel



Let it rain, mist or dew . . . for the lifetime of the car, stainless steel brightwork never needs care. Exposure to the elements can't harm it. You don't lift a finger or pay a penny to keep the showroom shine of *stainless*. ● Strong, hard, ever-bright stainless steel will serve you best on your new car, and protect top value when you sell. *And the chances are, it'll be* SUPERIOR.

Superior Steel

DIVISION OF

COPPERWELD STEEL COMPANY

CARNEGIE, PENNSYLVANIA

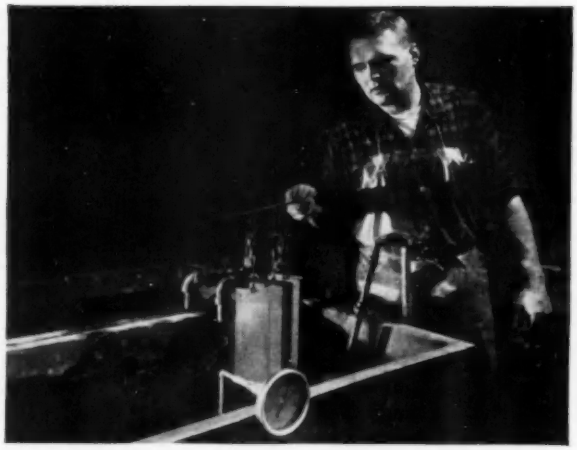
ANNOUNCING SERSEAL*

(trademark)

a new chemical blanket for hot phosphating baths

REDUCES FIXED OPERATING COSTS

BEFORE SERSEAL, steam, vapors and fumes escape from the bath, make working conditions unpleasant, lowering morale.



SERSEAL HAS BLANKETED THE BATH in just 10 seconds. All steam, corrosive fumes and vapors are contained within bath.

8 REASONS WHY ➡

1. Reduces the cost and time required for maintenance of heating elements.
2. Improves working conditions both from a comfort and health standpoint. Steam, heat, fumes and vapors are contained within the bath.
3. Saves up to 70% in heating costs.
4. Cuts warmup time. The blanket prevents heat loss.
5. Less corrosion of surrounding equipment. Corrosive elements are retained in the bath.
6. Less equipment downtime. Baths require less replenishing. Equipment requires less maintenance.
7. Less exhaust equipment required. Since the bath is sealed, there is little escape of fumes and vapors. And in many cases, ventilating systems can be safely eliminated.
8. Lower chemical cost and also less critical control necessary on some processes.

*Patent applied for

Write us today for complete information about this new cost-reducing chemical blanket for hot phosphating baths

AMERICAN CHEMICAL PAINT COMPANY

Ambler 24, Pa.

CHEMICALS ACP PROCESSES

Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont.

New Chemical Horizons for Industry and Agriculture

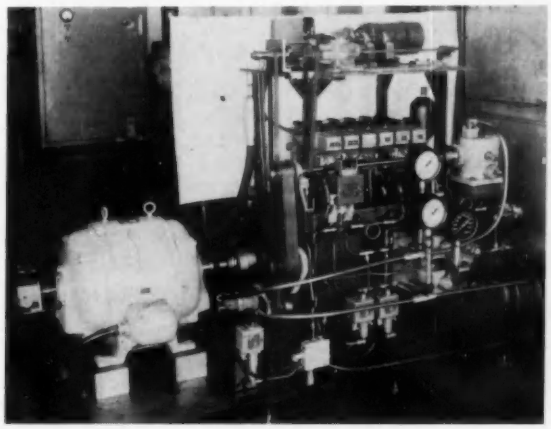
News of the
MACHINERY INDUSTRIES

(*Continued from page* 81)

The new shop is prepared to handle all phases of die making, from design to tryout, with one exception. Clearing does not have its own foundry, and cast steel die blocks are made in a cooperating foundry for them. The machine departments of Clearing Machine Corp. do the slab milling and profiling, and the dies then go to the die shop for finish machining, grinding, and honing. Two spotting presses have already been installed, and more are to be set up. A tryout press will be installed shortly, so the dies can be tested in operation before shipment.

As the only shop in the area producing large dies, Clearing has already completed some important orders. They recently shipped 19 large dies to Fisher Body Div. of General Motors Corp. in a single week.

Bullard Develops Variable-Speed Drive



Prototype of the hydro-mechanical infinitely-variable-speed drive designed by Bullard

A prototype of a hydro-mechanical infinitely-variable-speed drive, featuring constant horsepower output over a wide speed range, has been designed, built and tested at The Bullard Co. While not yet ready for commercial application, it has successfully passed its tests. At present, refining of the control system and design of the commercial package is in process.

Coupled to a vertical turret lathe, the 40-hp prototype gives a smooth transition of output speeds from 0 to 1800 rpm. In one test, the face of a large-diameter steel disk-like part was machined from perimeter to center at a constant fpm cutting speed and constant horsepower. Smoothness of speed changes was demonstrated by suddenly reducing the speed to 0 with a carbide tool buried in the cut and immediately increasing the speed to 300 fpm with the tool still in the cut. No damage to the tool or work occurred. Extended overload tests up to 75 hp showed no damage to the transmission. From no-load condition to full load, even with instant loading, there was no perceptible drop in rpm.

The operating principle of the new drive includes the combining of planetary differentials with two small-size positive-displacement hydraulic units. The heart of the drive comprises two planetary differentials so interconnected that during the operation of one, the other is preconditioned to take over where the first left off, and vice versa. While a drive can be built employing this nucleus, the 40-hp prototype employs two additional planetary differentials which are so connected to the heart of the drive that three separate but continuous ranges of speed are

(*Turn to page* 138, *please*)

IMMEDIATE service on Southern quality fasteners from a warehouse near you*— that's the story Southern Screw Company backs up with performance!

Send us your requirements for quotation by return mail, or faster if you request it.

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IN FASTENERS SOUTHERN IS

service

Southern SCREW COMPANY
STATESVILLE • NORTH CAROLINA

POWDER METALLURGY

Cont'd from page 56

Scores Impressive Gains

One gigantic press, said to be the world's largest for making powder metallurgy parts, is now in limited operation. The 125-ton unit reportedly can exert 6,000,000-lb pressures and turn out parts up to 30 in. O.D. It is claimed that a production rate of 100-150 large parts per hour can be achieved, depending on the part size and material used.

Another important technological development, particularly as far as the automotive field is concerned, has been the evolvement of infiltrated parts from the experimental stage into widespread commercial application. These are made by first forming a porous steel structure or "skeleton" and then infiltrating the pores with molten copper or brass to form a 100 per cent dense metal structure with high strength, elongation and wear characteristics. The resulting tough material is especially advantageous for such parts as gears where high stresses are encountered.

While only indirectly related to ordinary powder metallurgy fabrication, the direct rolling of metal powders into solid strip has also become a commercial reality. Copper powder, for example, is now being rolled into sheets of solid strip for use on automotive radiators.

Powder metallurgy has also made great progress in the metal cutting field. As a matter of fact, it owes much of its present state of advancement to cemented carbide. Used to replace tool steels in high-speed machining operations, the cemented carbide tool bit is a standard item in machine shops and is generally found wherever exceptional wear resistance is demanded. In powder metallurgy processing itself, tool life is multiplied many times by using carbide tools or die liners.

Recent developments include the use of boring bars of a high density material, produced by powder metallurgy techniques, to bore cylinder blocks. The excellent damping characteristics of metal powders have also enabled the manufacture at low cost of such other tools as single-point shanks for lathes.

Composition of the Industry

There are today approximately 60 custom fabricators and 20 in-plant or "captive" fabricators of powder metallurgy parts (including those specializing either in filters or friction materials). The former category includes such familiar names as: Keystone Carbon Co.; Amplex Div., Chrysler Corp.; Bound Brook Oil-Less Bearing Co.; The Presmet Corp.; John-

MAXIMUM PERFORMANCE
MINIMUM MAINTENANCE

Through advanced design and creative engineering, BORG & BECK has stepped up the capacity of its passenger car clutches without increasing their over-all dimensions. Compact, light in weight, precision built—for maximum performance, minimum maintenance.

for that vital spot *where power takes hold of the load*

BORG & BECK CLUTCH — THE STANDARD

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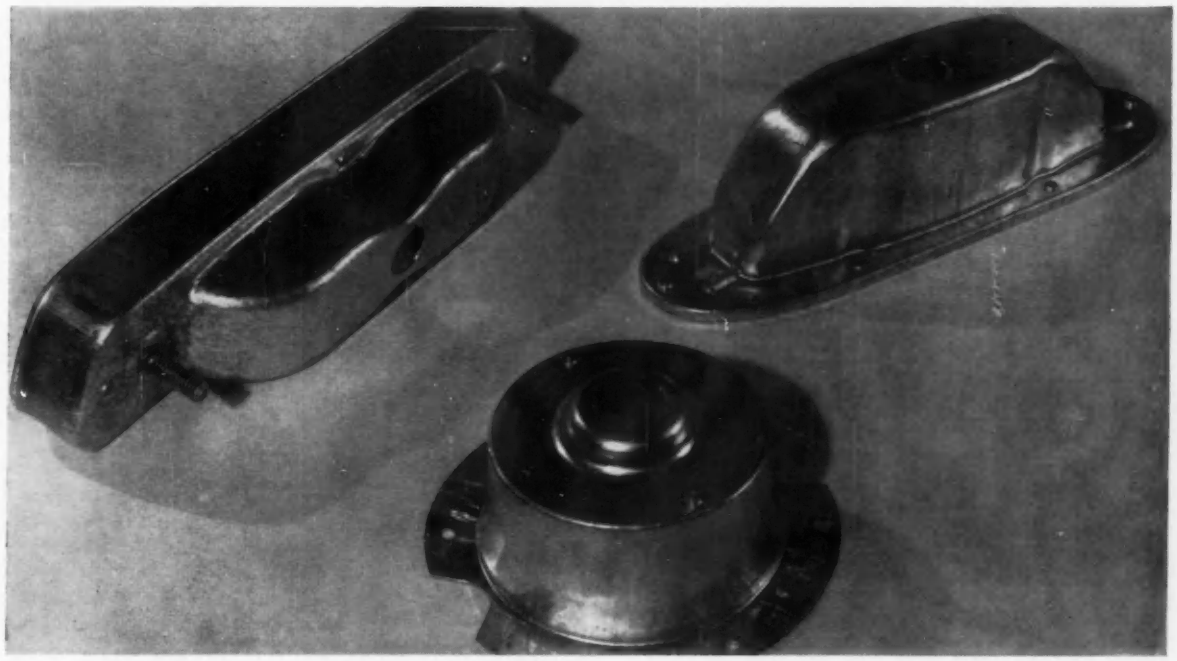
BORG & BECK

DIVISION OF BORG-WARNER

Chicago 38, Illinois

even after severe working...

Auto parts stay Zinc-Protected with Armco ZINCGRIP Steel



zinc coating stays intact because it flows with the base metal

Rust can't find a foothold on these parking lamp housings for 1958 model automobiles. There are no zinc-bare spots. And Armco ZINCGRIP® Steel is the reason why.

In spite of operations that draw, form, and pierce this durable steel, the hot-dip zinc coating continues to protect the base metal. It does not flake or peel.

Why not consider this workable, rust-resisting steel for parts *you* make that require severe fabrication and must fight corrosion? It's available in coils for use in high-speed production equipment.

To get the full story, just fill in and mail the coupon or call your nearest Armco Sales Office. There's no obligation.

Your Armco Sales Office can also supply complete data about other Armco Steels for top-quality automotive products. They include stainless steels, ALUMINIZED STEEL, ZINCGRIP PAINTGRIP®, High Strength Steel, Long Ternes, Steel Tubing, and high-quality Hot- and Cold-Rolled sheets.

ARMCO STEEL CORPORATION
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Company_____

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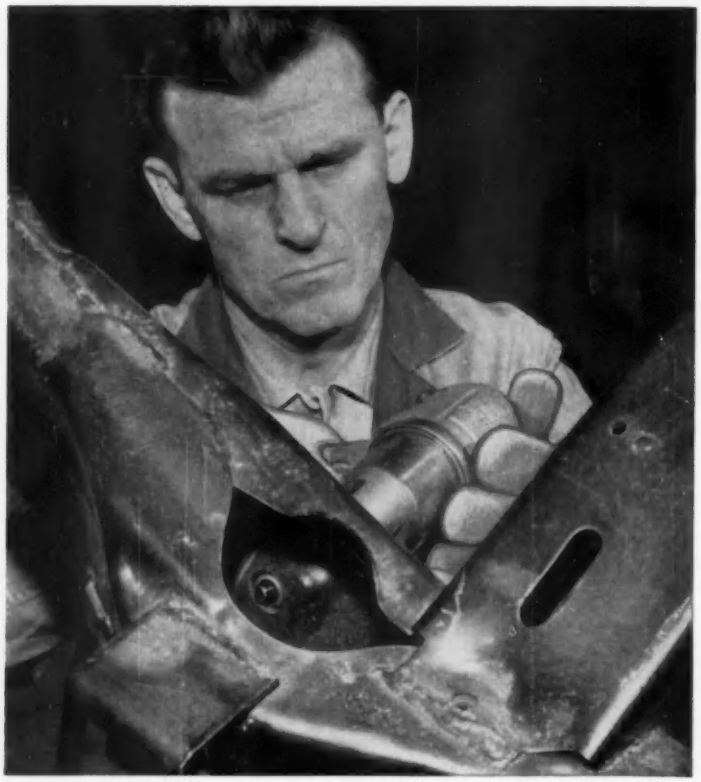
SHEFFIELD DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION



Specify MIDLAND

WELDING NUTS

for those hard-to-reach spots

Whether you're designing or fabricating, check your fastenings. Are they in hard-to-reach places? Does assembly take two men? Those are the spots for Midland Welding Nuts.

Midland Welding Nuts take seconds to apply, yet they save hours in assembly time. And, they're a better fastener. Spot welded into place for the life of the product, Midland Welding Nuts can't come loose or cause annoying rattles.

Want cost and time-saving tips? Send for the free booklet showing you how to "Save with Midland Welding Nuts."

MIDLAND-ROSS CORPORATION

WELD NUT DIVISION

6660 MT. ELLIOTT AVENUE • DETROIT, MICHIGAN

son Bronze Co.; Moraine Products Div., General Motors Corp.; Raybestos-Manhattan, Inc.; Supermet Div., Clobe Industries, Inc.; U. S. Graphite Corp.; and Burgess-Norton Co.

Most powdered metal parts today are made by custom or job shop fabricators because their "know-how", equipment, and experienced technical personnel qualify them as specialists in what is unquestionably an intricate art. However, some manufacturing companies, involved in the production of short-run items or in marginal applications that would be uneconomical for a custom fabricator to handle, have set up their own "captive" fabricating facilities. Among them are such companies as: International Business Machines Corp.; Link-Belt Co.; Ford Motor Co.; The Lionel Corp.; The Maytag Co.; Pitney-Bowes, Inc.; National Cash Register Co.; and Underwood Corp.

Outlook for the Future

Interest in powder metallurgy as a modern and economical method of metal forming is running at a high peak and should continue to do so in the years ahead. Its steady progress in the direction of larger parts, made possible by improvements in presses, pressing techniques, and powders, points to a bright future.

Total industry sales in 1957 hovered near the $80 million mark, and the majority of powdered metal parts producers feel that 1958 will be a relatively good year. New markets are constantly being opened up and lesser ones expanded. For example, some of the slack found this year in declining automobile sales will be taken up by a growing volume of aircraft and missile orders.

Powder metallurgy has developed so rapidly and progressed so far in such a short time that many designers and engineers are still not fully aware of what it is and what can be done with it. This deficiency is steadily being overcome by the spirited education programs being conducted by metal powder suppliers, producers of powder metallurgy parts, and the Metal Powder Association. The discovery and development of

KENWORTH'S *new mountain movers feature* FULLER *Transmissions*

Probably the largest rear-dump semi being built today, Kenworth's 42′ 2½″ rock and ore mover is equipped with a Fuller heavy duty 4-speed Transmission.

The 228,000 lb. gvw Kenworth 803-B is designed to haul top payloads profitably over varied terrain. It is powered by a single 12-cylinder diesel engine, offered in either the 400 or 600 hp range. In the 400 hp version, illustrated, a Fuller 4-speed 4-MS-1440 Transmission with CO-11,500 Twin Disc Torque Converter delivers power efficiently and effectively from the powerful Cummins NHV series engine. These heavy-duty Fuller Transmissions provide the right gear ratios to apply the power profitably.

More than 100 different transmission models are available for rubber-tired equipment from 100 to 600 hp, 330 to 1550 cubic inch engines. Check with your truck manufacturer or write Fuller for the right transmission for *your* job.

FULLER

TRANSMISSIONS

FULLER MANUFACTURING CO. Transmission Division • Kalamazoo, Mich. Unit Drop Forge Div., Milwaukee 1, Wis. • Shuler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest. Dist. Office, Tulsa 3, Okla.

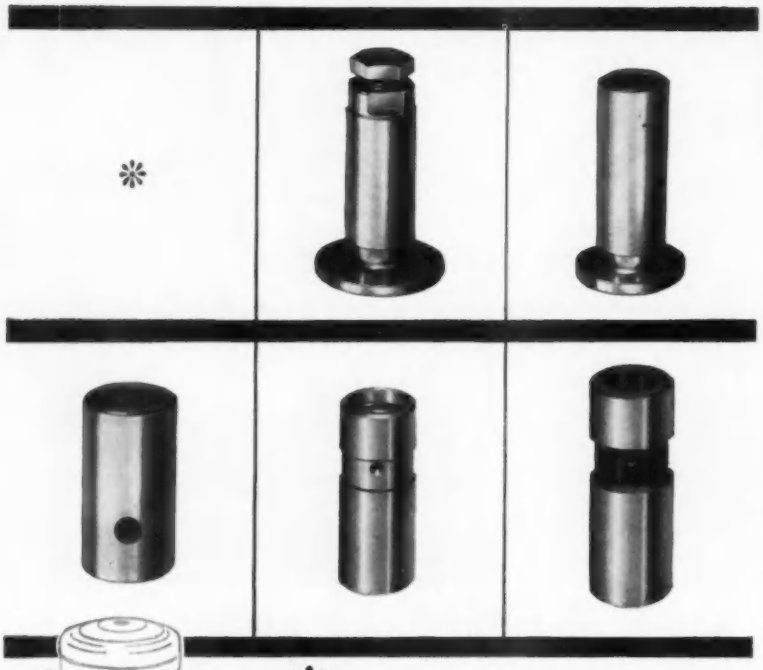
further applications for powder metallurgy should make as exciting drama in the future as its development to date has provided.

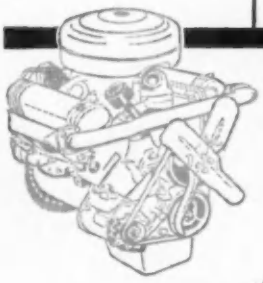
More Government Contract Awards

LATEST contracts awarded by various Government agencies, and covering primarily automotive and aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, etc. This list is for the period Feb. 25 to Mar. 31, inclusive.

BELL HELICOPTER CORP., Fort Worth, Texas
HU-1A helicopters, spare parts, ground support equipment and data—$3,000,000

JOHNSON *tappets*





keep pace with today's engines

Continual experimentation and excellent manufacturing methods show a steady product improvement that make JOHNSON TAPPETS worthy of your consideration. Only proven materials, covering a range of steel, chilled iron, and various iron alloys are used in the manufacture of JOHNSON TAPPETS, providing greater strength, light weight and increased wear resistance. Serving the AUTOMOTIVE — AIRCRAFT — FARM — INDUSTRIAL — MARINE Industries.

"tappets are our business"

JOHNSON JP PRODUCTS inc.
MUSKEGON, MICHIGAN

BRIGGS & STRATTON CORP., Milwaukee, Wis.
Engine assembly—408 ea.—$39,056

CATERPILLAR TRACTOR CO., Peoria, Ill.
Tractor, full tracked, low speed—400 ea.—$7,815,320

CHRYSLER MOTORS CORP., Washington, D. C.
Trucks—56 ea.—$151,155

THE CLEVELAND AUTOMATIC MACHINE CO., Cincinnati, Ohio
Screw machine, automatic single spindle, horizontal bar, cylindrical type turret—1 ea.—$29,841

CONTINENTAL AVIATION & ENGINEERING CORP., Detroit, Mich.
Repair and overhaul of J-69-T9 turbojet engines—129 ea.—$441,381

CONTINENTAL MOTORS CORP., Muskegon, Mich.
Tank engines, Model AVI-1790-8—233 ea.—$2,912,500

CROWN COACH CORP., Los Angeles, Calif.
Buses—10 ea.—$302,446

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.
Repair parts for Nike System—(1) $142,873; (2) $44,080
Structural airframe spare parts—various—$26,124
Honest John improvement program—$294,521

DOUGLAS AIRCRAFT CO., INC., Tulsa, Okla.
Fabrication of modification kits and spare parts for B-47 type aircraft—job—$300,000

FAIRBANKS, MORSE & COMPANY, Fair Lawn, N. J.
Repair parts for Diesel engines, various—602 ea.—$96,927

FIRESTONE TIRE & RUBBER CO., Los Angeles, Calif.
Guided missile, surface to surface—$28,603

FORD MOTOR CO., Ford Div., Washington, D. C.
Trucks—28 ea.—$72,835

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis.
Trucks, dump body and snow plow—1 ea.—$22,185

GENERAL MOTORS CORP., Chevrolet Motor Div., Detroit, Mich.
Trucks—5 ea.—$11,767

THE GENERAL TIRE & RUBBER CO., Akron, Ohio
Main wheels and brake assemblies for T-37A aircraft—$196,859
Nose wheel assys., 38x11, for KC-135A aircraft—$47,954

GILFILLIAN BROS., INC., Los Angeles, Calif.
Replenishment repair parts for the Corporal Missile System—$230,292
Emergency and blue streak requirements of spare parts for Corporal Missile System—$44,557

B. F. GOODRICH CO., B. F. Goodrich Aviation Products, Dayton, Ohio
Spare wheels for B-47 aircraft—$808,000

THE GOODYEAR TIRE AND RUBBER CO., Akron, Ohio
Spare parts for B47, F94, T33, F80, C54, B25, B26 aircraft—$32,189

GRAND CENTRAL AIRCRAFT CO., Glendale, Calif.
Modify aircraft T-29B Serial #51-5144A—$33,778

INTERNATIONAL HARVESTER CO., Washington, D. C.
Buses—5 ea.—$23,839
Trucks—10 ea.—$48,067

(*Turn to page 122, please*)

(Advertisement)

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Select proper bolt diameter

An erroneous rule of thumb worth forgetting is that no bolt under ⅝" should be used where fastened members are under stress. Yet bolts ½-inch and smaller take plenty of external loading.

HOW TO LOOK AT IT

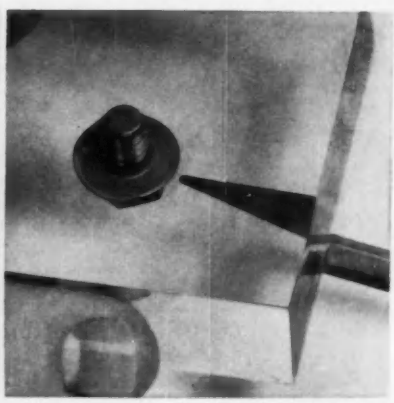
Primarily, you have to satisfy the stress requirements . . . the load. So select bolts on that same basis: the actual strength to sustain that load.

Calculating the strength requirements will tell you what bolt tensile, size, and number you need. If smaller bolts suffice, use them to avoid the penalty of overdesign. Holes can be smaller which means faster drilling and tapping. You have a chance to save materials since with smaller bolt holes, fastened members can often be made smaller too. You may also be able to standardize on a single size, saving assembly-line time.

SIZE VS. SAFETY

Remember that for a given grade of material, size tells you *capacity* of a bolt, not its *safety*. If you *tighten* a bolt to capacity, then you get safety. That's why a smaller bolt properly tightened is better and safer than a larger bolt sloppily tightened, especially where the loads are dynamic. Obviously, you reduce risk of under-torqued bolts as you reduce their size.

The new RB&W "SPIN SEAL" fasteners have spring-type washer with adhering flow-in seal . . . pre-assembled to standard machine or tapping screw.



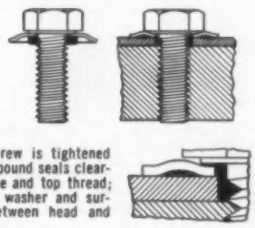
Flow-in sealant is confined by washer. Note how seal fills space under head and flows around and into threads in tightened SPIN-SEAL screw.

New SPIN-SEAL* screws give leakproof fastening

Here is a new type of composite fastener that seals by means of a unique flow-in sealant and washer.

ASSURES TRIPLE SEAL

Concave in shape, the heat treated springy washer confines and controls the flow of sealing compound. Tightening the screw forces sealant into various spaces around (1) threads, (2) head and (3) clearance hole to give hermetic sealing.



When screw is tightened the compound seals clearance hole and top thread; between washer and surface; between head and washer.

The washer has ability to conform to curved surfaces and still seal securely against hydrostatic pressures and wind driven water. Its spring tension and flat rim give the added advantage of dynamic metal to metal seal.

ONLY THE SCREW TURNS

Washer does not turn with the screw. This prevents twisting or tearing the sealing "gasket", marring of polished surfaces, or gouging of painted finishes.

The flow-in gasketing compound is plastic rather than elastic. Stable and non aging, it won't split or ozone-check under pressure. It gives controlled flow into clearance spaces. Compounds are available to seal out water or oil.

Send for Bulletin SS-1 which gives details on RB&W "SPIN-SEAL" fasteners. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y. *T.M.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

he **HAD** to use a sanding block!

but **YOU** can use a Buckeye Air Tool!

Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, if you're using Buckeye air tools, you can almost forget about tool maintenance.

In Air Tools, Your Best Buy Is Buckeye

There was a time when muscle power—and plenty of it—was needed to finish off a smooth surface. Today, air power, directed through a Buckeye tool, has replaced muscle power. The work gets done faster, naturally . . . and better, of course.

We don't imagine you're still using a wood block and emery cloth, but it's just possible you're not using a modern Buckeye air tool. And that's the only way you can be sure you're doing your finishing work the best and most economical way.

Our Catalog A-10 contains complete information on the entire line of Buckeye abrasive tools, all of it both interesting and helpful to all portable tool users. If you don't have a copy, send us your name, company and address and we'll correct that situation promptly.

Buckeye Tools
CORPORATION
DIVISION 21 • DAYTON 1, OHIO

(*Continued from page 120*)

KEARNEY & TRECKER CORP., Milwaukee, Wis.
Milling machines, Type 1, size #4; milling machines, Type 1, size #5—$87,900

MACHINERY ASSOCIATES, INC., Wynnewood, Pa.
Screw cutting lathes, type 1; screw cutting lathes; screw cutting lathes, tracer controlled—$49,842

MACK TRUCKS, INC., Washington, D. C.
Differential driving axle—$38,739

THE NATIONAL ACME CO., Cleveland, Ohio
Screw machine, automatic, single, spindle, horizontal bar—$90,705

NORTH AMERICAN AVIATION, INC., Canoga Park, Calif.
Rocket engines—$2,278,000

OSHKOSH MOTOR TRUCK, INC., Oshkosh, Wis.
Trucks, dump body and snow plow—4 ea.—$58,388

SILENT HOIST & CRANE CO., INC., Brooklyn, N. Y.
Truck, lift, fork Diesel engine driven, 15,000 lb capacity—19 ea.; onboard repair parts—19 set; dwgs.—3 sets; technical manuals—114 ea.—$257,060

UNITED AIRCRAFT CORP., Hamilton Standard Div., Windsor Locks, Conn.
Propeller equipment, 4 bladed for C-130B aircraft—$9,664,915

UNITED AIRCRAFT CORP., Sikorsky Aircraft Div., Stratford, Conn.
H-34A helicopter, spare parts, special tools & CHE—$166,533
H-37A helicopters, spare parts, special tools, data and engineering changes—$16,800,000

VICKERS INC., Detroit, Mich.
Automotive spare parts, motor assembly—16 ea.—$44,494

WESTERN ELECTRIC COMPANY, INC., Burlington, N. C.
Nike spare parts and components—$539,969

WESTERN ELECTRIC COMPANY, New York, N. Y.
Nike spare parts and components—$1,556,481

WILLYS MOTORS INC., Toledo, Ohio
Trucks—56 ea.—$111,447

BOOKS . . .

FASTENERS HANDBOOK, *by Julius Soled, published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price, $12.50.* This handbook provides ready, up-to-date answers to fastening problems in all fields. It includes information on standard and proprietary fasteners from all manufacturers. Here the reader will find listed the many specialized fasteners developed since WW II; specific fasteners that increase structural safety and reliability; and the whole range of sizes and types of material available. The actual uses of fasteners in one industry are related to possible uses in other applications. Besides giving examples of money-saving applications, the book also points out the advantages of many less known but equally valuable fasteners.

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Better Saws...

BEGIN WITH SHARON QUALITY SAW STEELS

Sharon metallurgists have for the past decade concentrated on the development of better saw steels. As a result, they have established an industry-wide reputation for steels with a balance of toughness and hardness to absorb maximum punishment without fracturing or dulling.

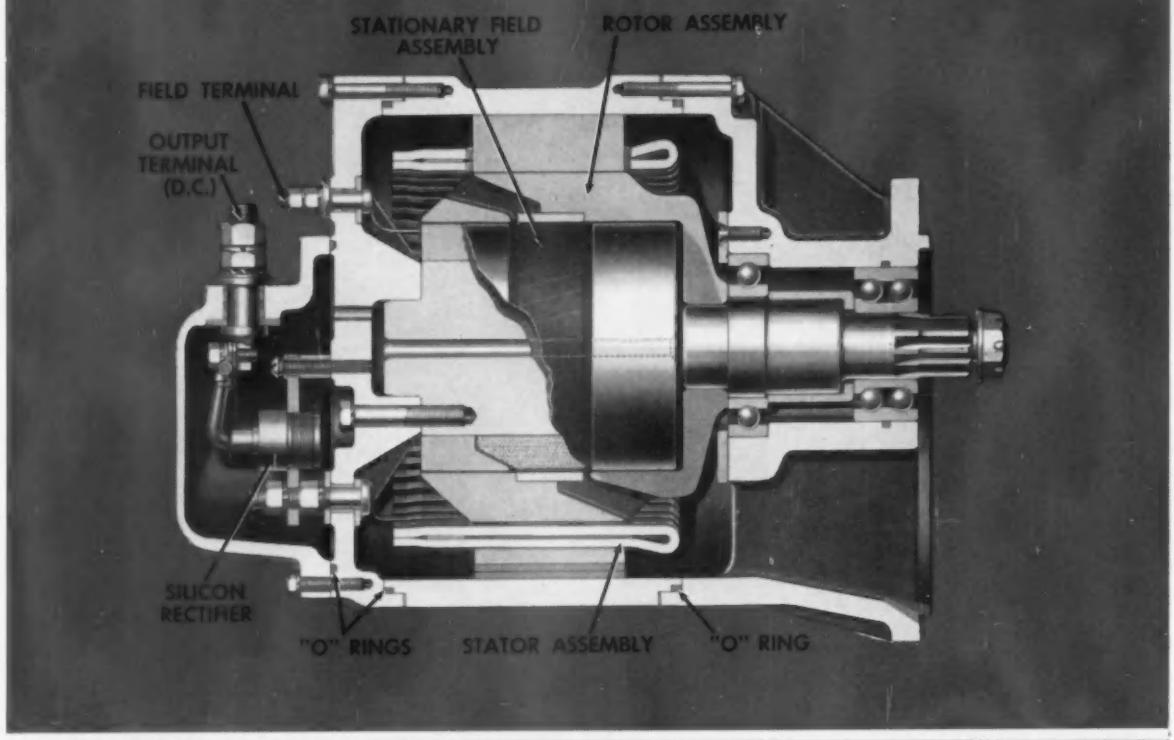
It will pay you to contact your Sharon salesman and get the facts on these durable, edge-holding steels for saws or any cutting tool or implement.

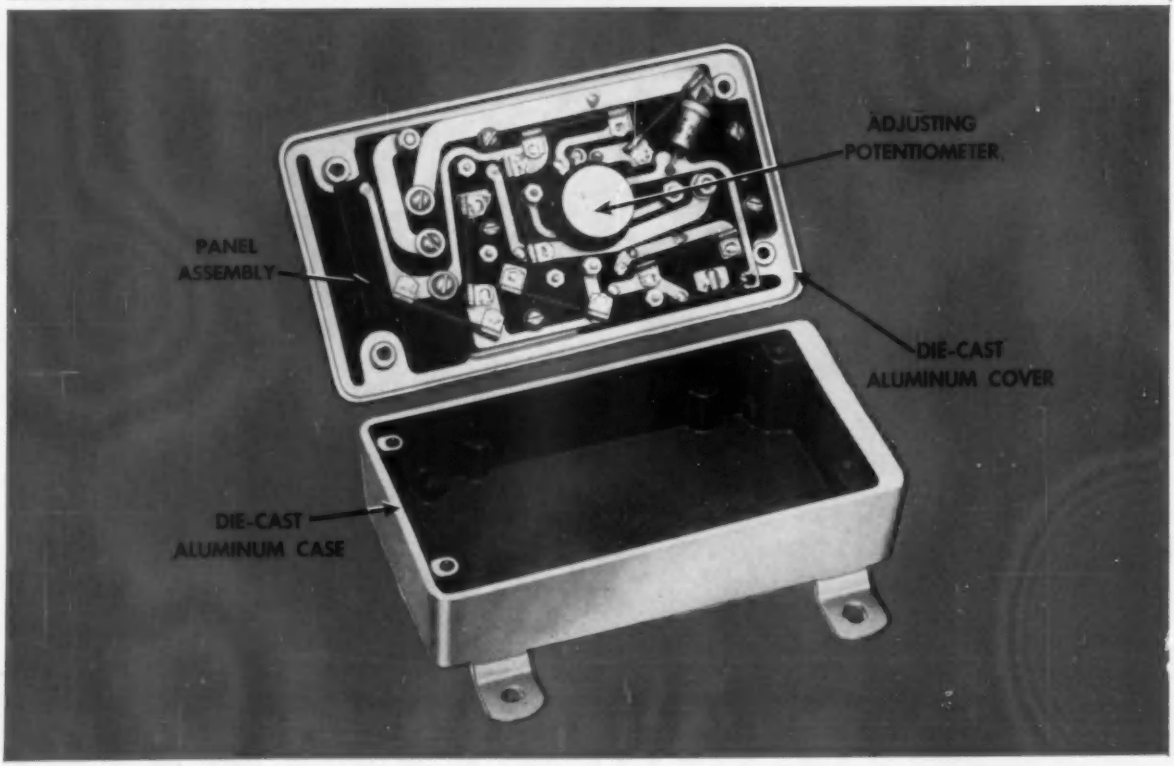
SHARONSTEEL

SHARON STEEL CORP.

SHARON, PENNSYLVANIA

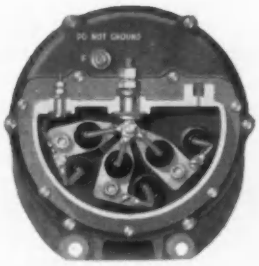
PROGRESSIVE ENGINEERING MAKES THE DIFFERENCE





TWO NEW FIRSTS FROM DELCO-REMY

End view showing rectifiers



OIL-COOLED A.C. GENERATOR WITH BUILT-IN RECTIFIERS

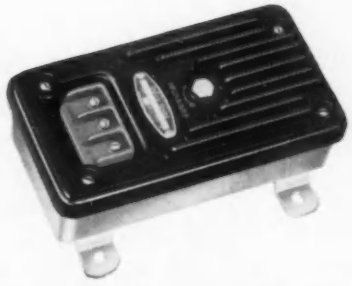
Now, a unique new a.c. generator with integral rectifiers *requires no periodic servicing!*

Developed by Delco-Remy engineers, in cooperation with GMC Truck and Coach engineers, this radically new generator is capable of a continuous output of 215 amperes at cruising speeds and 135 amperes at normal engine idle . . . performance ideally suited to modern coaches. It is a totally enclosed, brushless unit complete with compact, built-in, long-life silicon rectifiers. All mating structural parts are sealed with special high-temperature "O" rings. *The entire assembly is effectively cooled by a continuous flow of engine oil passing through the generator.*

Sealed construction of the new unit keeps out dust and dirt and prevents damage caused by detergents used in engine cleaning. Absence of brushes, slip rings, rubbing seals and air filters, *plus* a continuous supply of engine oil for bearing lubrication, eliminates the need for servicing between engine overhauls.

This revolutionary new oil-cooled a.c. generator with built-in rectifiers is an outstanding example of Delco-Remy engineering leadership in the automotive electrical field.

External view



ALL-NEW TRANSISTOR VOLTAGE REGULATOR

Delco-Remy's all-new transistor generator regulator represents a bold new concept in voltage regulation —an electronic unit composed of durable, long-lasting transistors and diodes *with no moving parts.*

This compact new regulator performs its function electrically rather than through electro-mechanical components. By using semi-conductors as voltage-sensitive and control devices it provides more accurate control of generator voltage, and handles much higher field current for better generator performance.

Since there are no moving mechanical parts, there are no springs, hinges, or contacts to maintain. Mounting position and vibration have no effect on its operation, and the adverse effects of temperature changes and humidity are practically eliminated. To the user this means long-lasting settings and the elimination of periodic maintenance.

This advanced design transistor voltage regulator is still another example of Delco-Remy progressive engineering at work for you.

GM GENERAL MOTORS

GENERAL MOTORS LEADS THE WAY—STARTING WITH **Delco-Remy** ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

Financing for Automotive Parts Manufacturers

(*Continued from page 72*)

amounted to $48,000, and there was $73,000 owed to the successful tool and die firm also operated by the three managing partners of ABC.

ABC's sales for the previous fiscal year, to Jan. 31, 1955, amounted to $157,000, and the company had a loss of $25,000 on these sales. Finally, the firm had a deficit net worth in the amount of $13,000.

The capital deficit and solvency were corrected by the three owners through "freezing in" the $73,000 owed to their other company, and Talcott started financing. Talcott took assignment of the firm's accounts receivable on a recourse basis, together with a mortgage on its machinery, and advanced ABC $75,000 immediately, using the receivables and mortgage as collateral.

With this available cash as a start, ABC was able to produce, sell, and profit more. One year later—for the fiscal year ended Jan. 31, 1956—the company reported sales of $1,320,000 and a net profit of $18,000. The deficit net worth had reversed itself and the company now had a net worth of $5000. In that year, Talcott had advanced ABC on a revolving basis a total of $1 million—many times the firm's net worth.

In the following year (to Jan. 31, 1957), sales amounted to $1,886,000, all financed by Talcott advances, and net profit reached $209,700. The firm's net worth during this year increased from $5000 to $114,000.

By mid-1957, ABC's need for commercial financing had decreased considerably, for the firm had accumulated sufficient working capital of its own through profits to meet its requirements. In October, 1957, the interim financing arrangement with Talcott ended, as anticipated. If ABC again needs outside borrowings, it is now in a position to receive adequate bank financing.

Cash Needs Met by Commercial Financing

By Theodore H. Silbert
President
Standard Financial Corp.

MANY manufacturers of automotive parts and accessories are beginning to worry about the danger of running out of cash. Reserves are dwindling when money needs are growing. Dun & Bradstreet reports the following ratios of current assets to current debt for the industry:

1953	2.95
1954	2.99
1955	2.50
1956	2.54
1957	(not available yet)

The relationship between current debts and cash on hand is being closely watched in most businesses. When judged by this relationship,

Thoroughly Proved...
BY YEARS OF HARD EVERYDAY USE IN THOUSANDS OF PLANTS
HANSEN
QUICK-CONNECTIVE
PUSH-TITE COUPLING
instant automatic flow and shut-off
quick connection and disconnection
leak-proof minimum wear locking device
integral factory assembled tamper-proof socket head
ONE-WAY SHUT-OFF
Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with Plug, thereby preventing wear and subsequent leakage.
The ability of Hansen Push-Tite Couplings to withstand severe service—with practically no maintenance—has been thoroughly proved by years of hard, everyday use in thousands of plants. The "socket head", which contains the locking device, is factory assembled into a rugged integral unit which cannot be readily injured or have component parts lost by casual tampering.
To connect the Coupling, you merely push the Plug into the Socket with one hand. Flow is instantaneous. To disconnect, push back sleeve on Socket—Coupling disconnects. Flow is shut off instantly and automatically.
QUICK-CONNECTIVE FLUID LINE COUPLINGS for
AIR • OIL • GREASE
HYDRAULIC FLUIDS • WATER
VACUUM • STEAM • OXYGEN
ACETYLENE • REFRIGERANTS
GASOLINE • COOLANTS
WRITE FOR THE HANSEN CATALOG
Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes and types of Hansen Quick-Connective Couplings. Write for your copy.
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SINCE 1915
QUICK-CONNECTIVE FLUID LINE COUPLINGS
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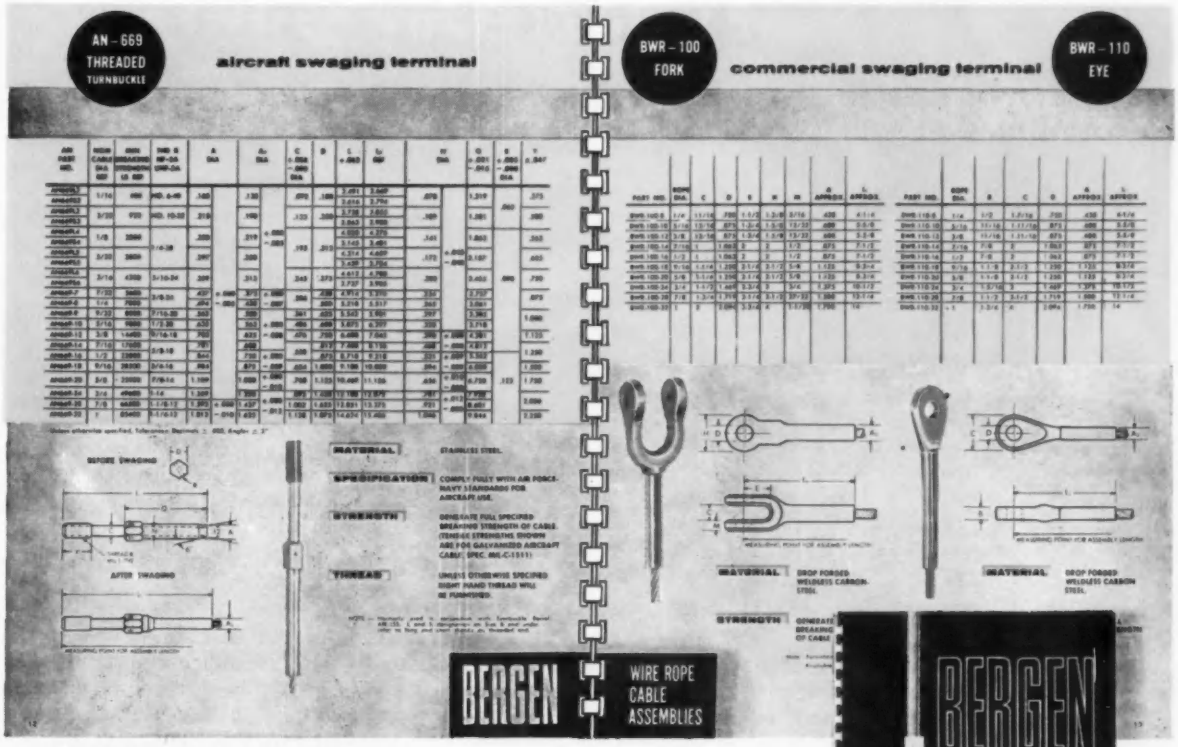
SAVE TIME...SAVE MONEY...IMPROVE YOUR DESIGNS



BERGEN'S NEW ASSEMBLY CATALOG PLACES COMPLETE DESIGN INFORMATION AT YOUR FINGER TIPS.

Bergen's Assembly Catalog, CA-1, is virtually a complete engineering handbook on wire rope cable assemblies, nylon coated cable, swaging and other subjects essential to the design engineer.
It illustrates terminals for all types of applications with detailed descriptions of their characteristics. It tells you how to select the best cable construction for your purpose . . . what cable types and materials give the best results under adverse conditions . . . how to assure flexibility . . . breaking strengths and similar data.
Send for your FREE copy and keep this design information handy in your files.

BERGEN
WIRE ROPE COMPANY

52 GREGG STREET, LODI, NEW JERSEY

SERVING THE LEADERS OF INDUSTRY

BERGEN WIRE ROPE COMPANY
LODI, NEW JERSEY

Kindly send me your new FREE cable assembly catalog CA-1.

Company _____

Street _____

City _____ State _____

Signed by _____ Position _____

Manufacturers of _____

PRODUCTION MORE THAN TRIPLED . . .

PAINT MILEAGE INCREASED 75% WITH

Ransburg

NO. 2 PROCESS

One Ransburg reciprocating disk uniformly coats 7 complete sets of gasoline pump housings and parts per gallon of paint. Former hand spray produced only 4 sets per gallon.

● Bowser, Inc. Fort Wayne Division is continuously on the lookout for improved manufacturing methods in the production of their quality line of gasoline pumps.

That's why they modernized their finishing department . . . installed a conveyor . . . new oven . . . and replaced hand spray with one RANSBURG No. 2 PROCESS reciprocating disk unit.

RESULTS? Paint mileage increased 75% with less labor. With hand spray, they painted enough pump housings and parts for 4 pumps per gallon of paint. Now, with *Electrostatic*, they're painting 7 complete pump sets per gallon.

Where Bowser formerly needed two shifts in finishing, one shift now handles even greater production. With hand spray and limited oven facilities, they used to turn out 15 sets per hour. Now, they can paint 55 sets an hour, either prime or finish. Color changes are made quickly and easily with Ransburg equipment, and because of its efficiency in operation, maintenance cost in the paint area is cut 50%.

NO REASON WHY YOU CAN'T DO IT, TOO!

Whatever your product, if it's painted, we'd like to tell you more about the worthwhile savings and advantages which can be yours with RANSBURG ELECTROSTATIC PAINTING PROCESSES. Write for our No. 2 Process brochure which cites numerous examples of electrostatic spray painting on a wide variety of products.

Ransburg **ELECTRO-COATING CORP.**
Indianapolis 7, Indiana

RANSBURG

reserves on hand today are really not much more comfortable than those of 1939, at the end of a depression. Reserves then came to about 43 per cent of current liabilities, compared with 47 per cent today and 73 per cent in 1946.

Larger companies with access to bank financing, long-term insurance company loans, and the public security markets, are getting most of the cash for business loans. The commercial finance industry thus proves a haven for the smaller and medium-sized companies which cannot get sufficient financing from their banks and are not large enough to go to the public.

The typical commercial finance company charges approximately 1 per cent per month for the funds it makes available to its client companies. Compared with, say, six per cent per annum from banks, the commercial finance rates seem too rich.

Yet, something might be said on the other side, which is not ordinarily realized by manufacturers. The Federal Reserve Board, in its most recent study on all forms of credit, pointed out that there are certain advantages which surround the commercial finance company funds.

For example, banks normally lend on the basis of a company's net worth or other fixed or inventory collateral. But an expanding company with a good many new orders piling in, usually does not have sufficient net worth to warrant a bank loan of the required size.

The commercial finance company does not bother much about a manufacturer's net worth. The finance company is usually concerned only with the customers to whom a manufacturer sells. If the accounts are good credit risks, then a manufacturer's acounts receivable are sufficient collateral for a commercial finance company.

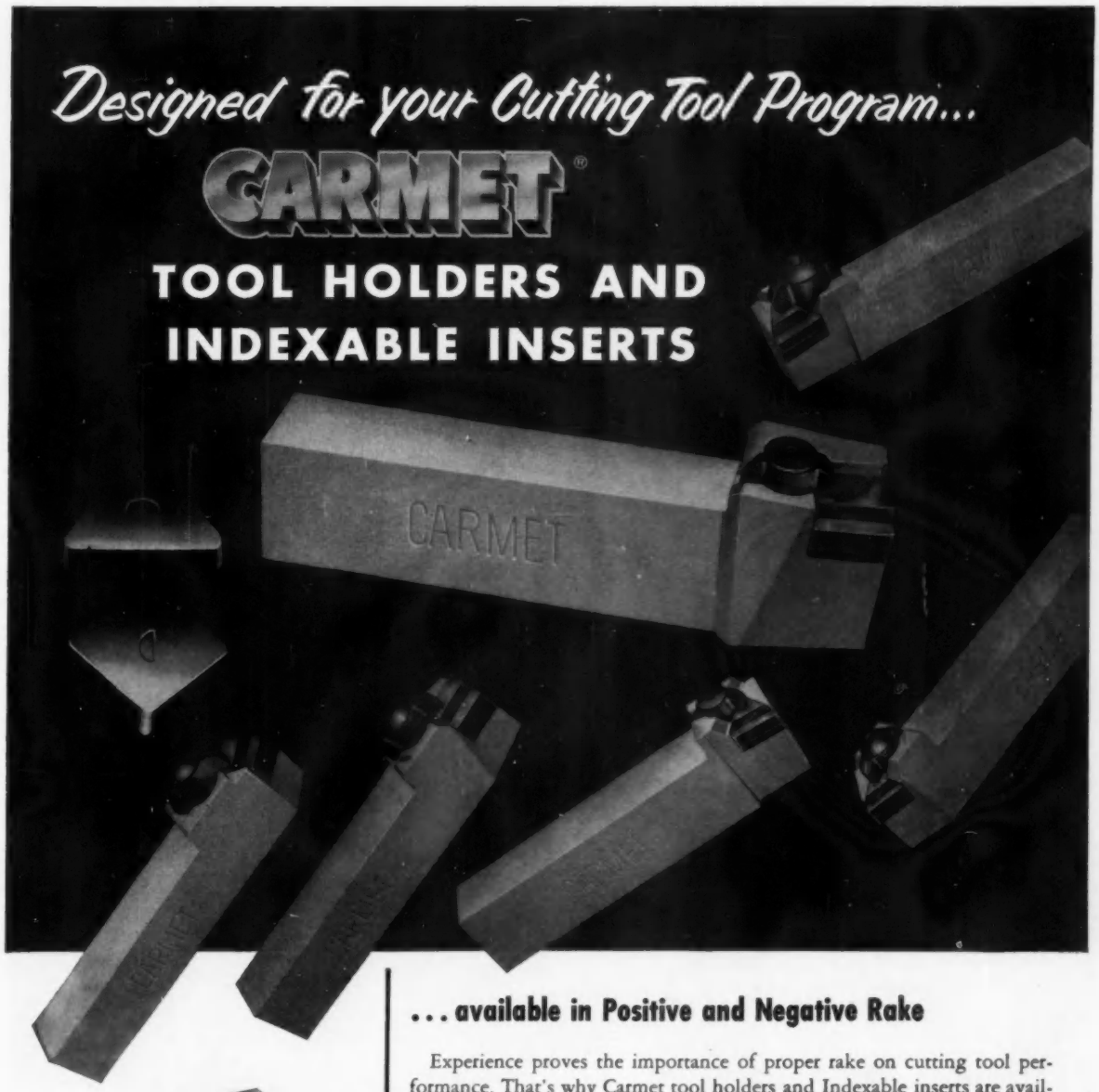
Moreover, as the Federal Reserve Board study also points out, funds from commercial finance companies are not paid for on a term basis, but on a daily basis. If a commercial finance company

(*Turn to page* 132, *please*)

Designed for your Cutting Tool Program...

CARMET®

TOOL HOLDERS AND INDEXABLE INSERTS



Write for this NEW CATALOG:
CARMET TOOL HOLDERS and INDEXABLE INSERTS

Expanded to 16 pages, this latest edition contains specifications of Carmet tool holders and Indexable inserts, replacement parts for tool holders, and information on choosing the proper carbide grade for the job.

ADDRESS DEPT. AI-4

WBW 6059

. . . available in Positive and Negative Rake

Experience proves the importance of proper rake on cutting tool performance. That's why Carmet tool holders and Indexable inserts are available in *both* positive rake (for light cutting on easy-to-machine materials) and negative rake (for heavy cutting on high tensile materials).

CHECK THESE FEATURES

- **Up to eight cutting edges on each carbide insert.**
- **Grinding is eliminated—no special reconditioning equipment needed.**
- **Each insert is permanently marked for easy grade identification.**
- **Tool holders cadmium plated to resist corrosion and chip erosion.**
- **Tool holder design permits quick, accurate indexing of inserts to new cutting edge.**
- **Inserts cost but a few pennies per each new cutting edge.**

Ask your A-L representative or distributor for engineering assistance in choosing the right tool for your requirements from Carmet's complete line.
Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.

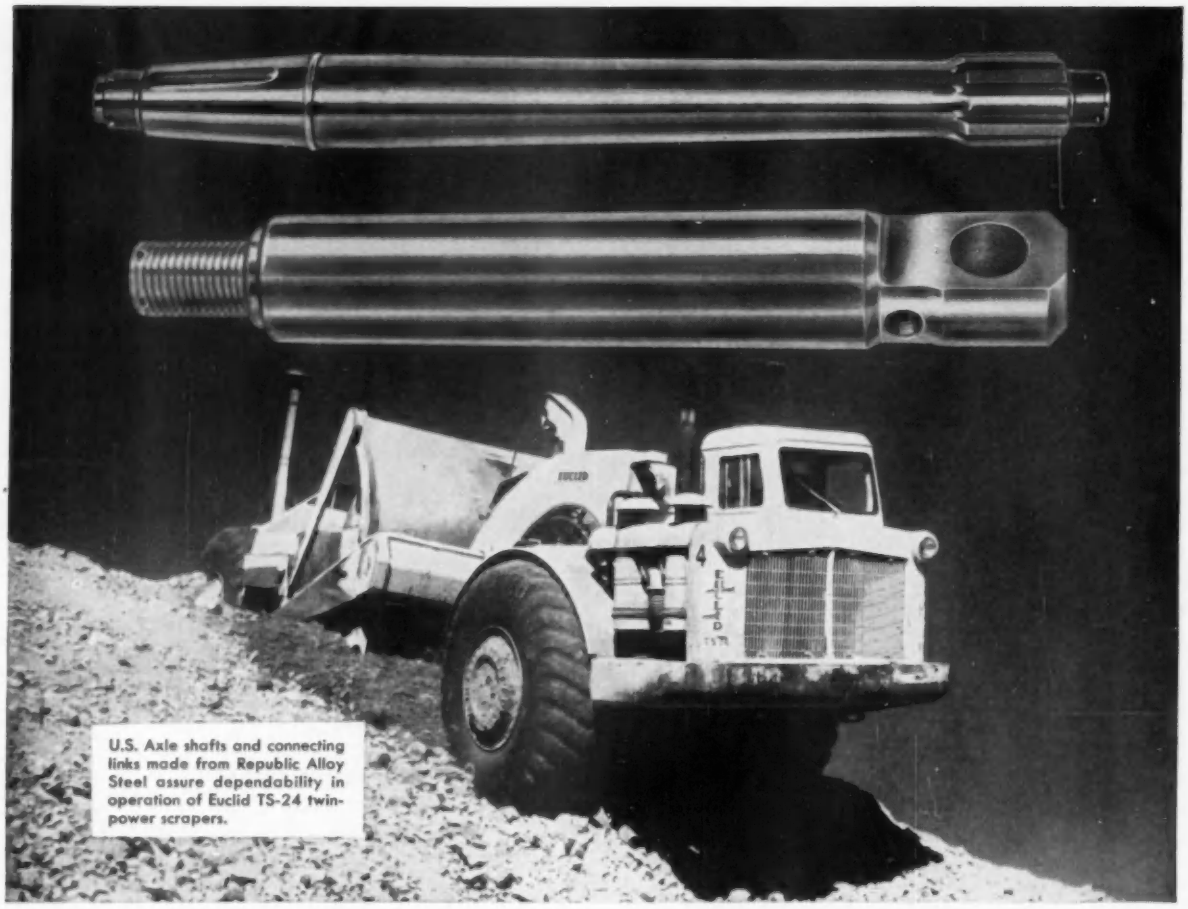
For all your **CARBIDE** needs, call

ALLEGHENY LUDLUM

Branch offices and distributors in all principal cities

Problem-Solving Products from Republic

MEET REQUIREMENTS FOR DEPENDABILITY, STRENGTH, ECONOMY, CLOSE TOLERANCE



U.S. Axle shafts and connecting links made from Republic Alloy Steel assure dependability in operation of Euclid TS-24 twin-power scrapers.

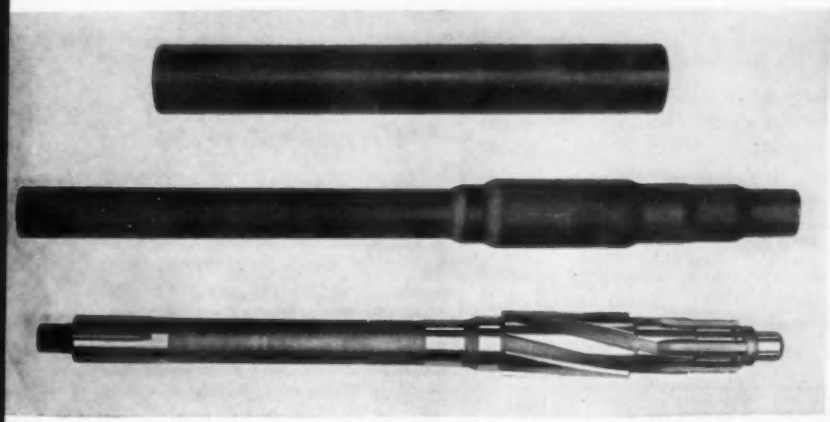
REPUBLIC ALLOY STEELS ADD DEPENDABILITY, TOUGHNESS, STRENGTH, QUALITY TO A PRESTIGE PRODUCT. Axle shafts and connecting links produced by The U.S. Axle Company, Inc., Pottstown, Pennsylvania, are known throughout the world for their extra stamina to withstand emergencies as well as everyday use.

To maintain their reputation for quality and dependability, U.S. Axle specifies only the finest materials, including Republic 4300 series hot rolled Alloy Steels.

These finest of steels provide the high strength, toughness, shock-resistance, and abrasion-resistance values needed to withstand the severe service to which the shafts and links are subjected. Alloy Steel's uniform response to heat treatment gives these parts hard surfaces around tough cores, providing maximum resistance to abrasion, friction, and wear.

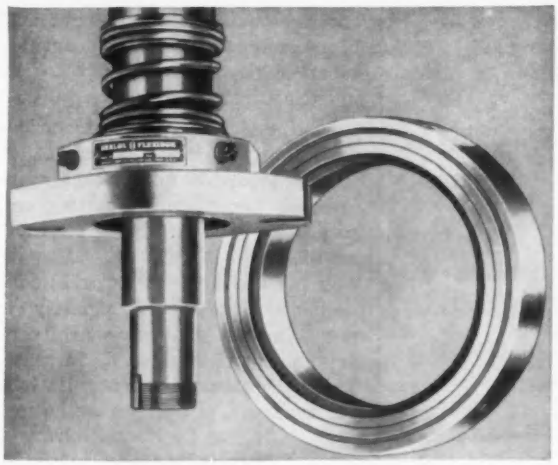
In Republic Alloy Steels you will find the highest strength values—plus an exceptionally high strength-to-weight ratio that permits the design of thinner sections to save weight and hold down size without any sacrifice of needed strength.

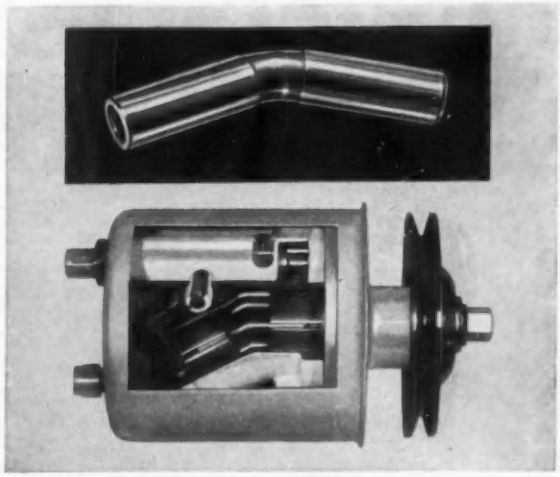
Specify Republic Alloy Steels to insure safety, to extend equipment life, to cut maintenance and replacement costs. Specify Republic Alloy Steels where strength and toughness must resist heavy-duty roughness. We offer you the services of our experienced field metallurgists to help you get the most from these versatile steels at the lowest possible cost. The coupon is your invitation to their services.



REPUBLIC DIE-FORM MEANS ECONOMY. This new fabricating process can save you 1 out of 3 tons of steel. The automotive transmission shaft, shown at left, proves the point. Using Die-Form, 200 tons of cold finished blanks produced parts formerly requiring 300 tons. Die-Form is a new method of cold forming hot rolled carbon, alloy, or stainless steel bars into multi-diameter blanks ready for final machining. It permits major savings in time, material, and money in mass produced, multi-diameter machine shafts. Since Die-Form closely approximates the final part, only finishing cuts and/or grinding are required for completion. Scrap loss is minimized—production rate increased. Send coupon for booklet describing the advantages of this new process.

REPUBLIC ENDURO® STAINLESS STEEL BARS provide a machine finish that looks as good as a ground finish. That's the performance report from machine operators at Sealol Corporation, Providence, Rhode Island. The company uses Free-Machining ENDURO bars in manufacturing mechanical shaft seals for application on fuel tankers, and in the aircraft, petroleum, food and chemical industries. The Sealol machine operators also report that they like the machinability of ENDURO bars—the fine surface finish, the accuracy of section, the uniform soundness, the ability of ENDURO to hold close tolerances. Send coupon for complete facts on Free-Machining ENDURO Stainless Steel Bars.





REPUBLIC ELECTRUNITE® MECHANICAL TUBING meets all close tolerance requirements for new automotive pump (above). The unusual ductility, uniformity, and workability of ELECTRUNITE Mechanical Tubing also meets the performance requirements of this hydraulic power pump designed and assembled by Thompson Products, Inc., Cleveland, Ohio. Will-O-Hill Industries, Inc., Willoughby, Ohio, subcontractor and specialist in close tolerance tubular stampings, cut 7/16-inch diameter ELECTRUNITE into units 2 3/16 inches long. Each unit is rolled to form a slight groove in the center, and bent to an angle of exactly 150°. Both ends are subsequently bent in a die, held to a tolerance of ± .0005 inches and finished to an O.D. to ± .0003 inches. Republic Engineers will work with you in solving precision problems and reducing costs with ELECTRUNITE Mechanical Tubing. Send coupon today.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. AI-5292
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Send more information on:
☐ Die-Form ☐ ENDURO Stainless Steel Bars
☐ ELECTRUNITE Mechanical Tubing
☐ Have an Alloy Metallurgist call.

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

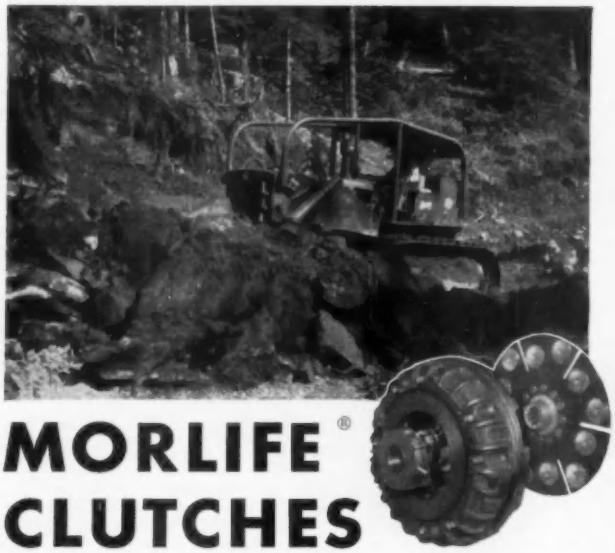
Financing for Automotive Parts Manufacturers

(*Continued from page* 128)

advances $100,000 to a manufacturer on the first of the month and the manufacturer's collections (for the most part) are completed on the 20th of the month. then the manufacturer merely pays interest computed on the reducing daily balances for the 20 days which he used for cash. The dollar for such funds is, therefore, scarcely more than term bank money.

Finally, as the Federal economists conclude, the availability of cash for a manufacturer to take trade discounts, will permit him to save almost as much as the cost of the funds which he borrows against his accounts receivable.

ROCKFORD



MORLIFE® CLUTCHES

Control Power Better in the Heaviest-Duty Machines

ROCKFORD Over-Center CLUTCHES, equipped with MORLIFE clutch plates, provide 100% more torque grip than previous type clutches of equal size. This permits the use of smaller diameter clutches. Easier operation is accomplished by reducing the required engaging pressure. 50% better heat disposal avoids down-time caused by burned or warped plates. Numerous field records prove that MORLIFE clutches operate 400% longer without plate replacement or adjustment. Let these NEW type clutches help improve the operation of *your* heavy-duty machines.

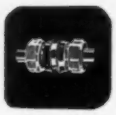
BW SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER
315 Catherine St., Rockford, Ill., U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

Small Spring Loaded

Heavy Duty Spring Loaded


Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

Flexibility in Commercial Financing

By J. S. Grimes
Executive Vice-President

Commercial Credit Corp.

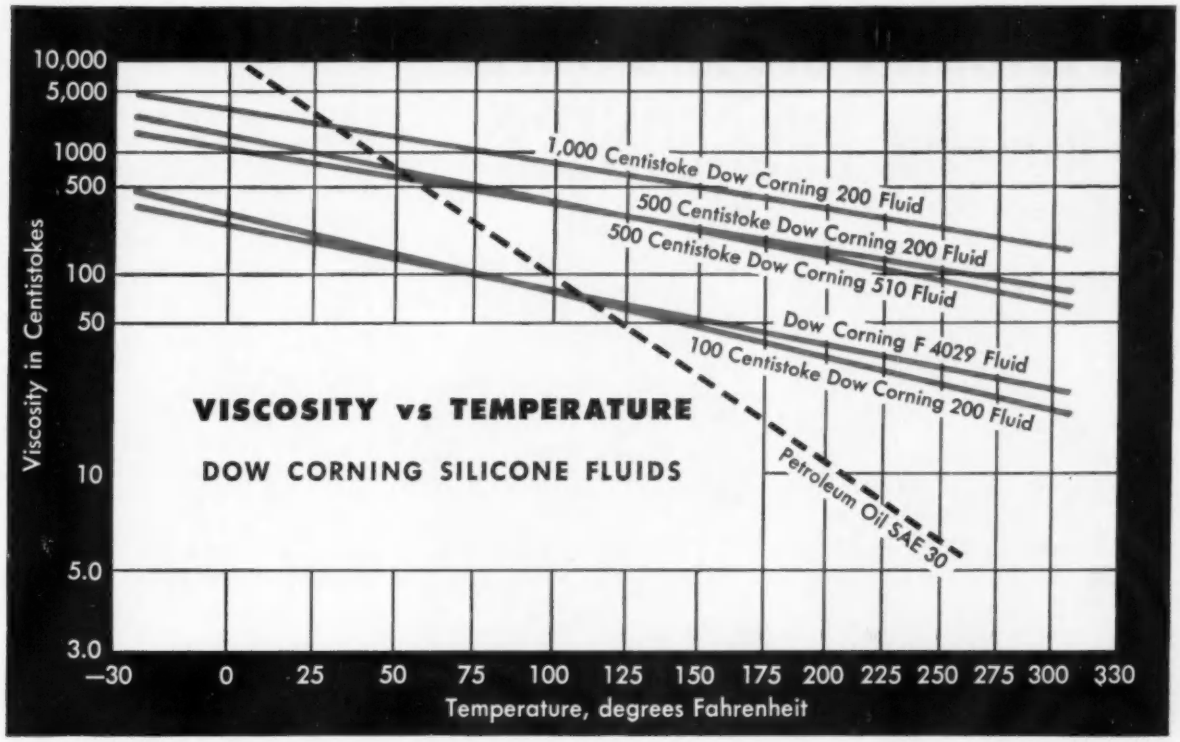
COMMERCIAL Credit Corp. and other commercial finance companies provide financing for current operations and capital expenditures of just about all types of manufacturers and wholesalers, including those engaged in the automotive parts field.

When a manufacturer enters into an agreement with a commercial finance company he does not have to worry about having operating cash tied up in accounts receivable arising from sales made on customary trade terms. As shipments are made, funds are obtained immediately on the accounts created. The arrangement is strictly a confidential one, as debtors are not notified that their invoices have been assigned, and they continue to make payments directly to the manufacturer.

In times of higher selling prices or rising volume, the amount of money available automatically increases. Commercial finance companies do not set limits on their advances in terms of ratios to working capital or net worth; consequently, borrowing capacity is not limited to any arbitrary amount but rises as needs increase. There is no need of negotiations for renewals, and there are no maturities to meet. Funds advanced against receivables are automatically repaid by the debtors paying the invoices financed.

When cash obtainable on accounts receivable is insufficient to meet the needs of a business, the commercial finance company advances additional funds against inventory, both raw materials and finished goods. As merchandise is sold and shipped, inventory loans are automatically liquidated by accounts receivable financing.

Most firms doing business today with commercial finance companies find that more cash is usually available from them than through other methods of short-term borrowing. They also are able to avoid



despite heat or cold . . .

Silicone Fluids MAINTAIN VISCOSITY

As the graph illustrates, Dow Corning silicone fluids are little affected by temperature changes. Their viscosity remains relatively constant over a wide span, whereas petroleum-base fluids thicken or thin out severely. In fact, Dow Corning Fluids are serviceable as low as —130 F and as high as 400 F.

here's where silicone fluids help . . .

Dow Corning Fluids are highly effective as damping media. For example, dashboard indicator needle vibration is eliminated, and crankshaft torsional vibration is damped with silicone fluids. In such applications, silicone fluids resist oxidation, give uniform performance regardless of geographic location or season.

Silicones are also excellent fluid coupling media. They transmit torque consistently despite varying temperatures and are highly resistant to breakdown due to shear. Silicone fluids are the transmission medium in such applications as the new auto engine fan hydraulic coupling.

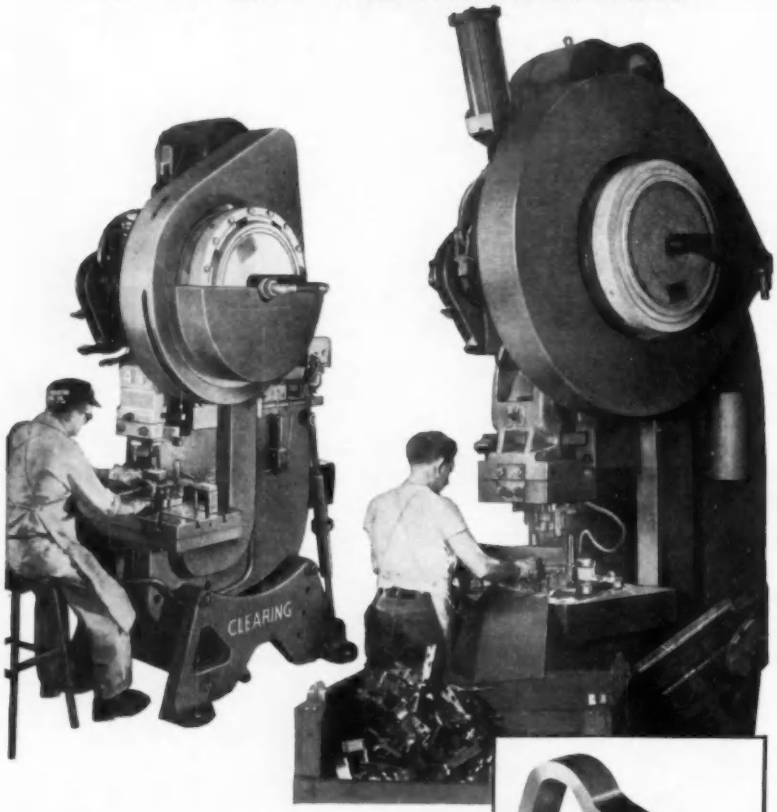
A high degree of compressibility . . . up to 12% at 20,000 psi . . . in combination with their many other desirable properties, renders silicone fluids ideal for liquid springs or similar hydraulic devices. In other applications, silicone fluids serve as lubricants for rubber, plastics and certain metal combinations and as heat-stable dielectrics.

These are typical of the many automotive applications for Dow Corning silicone fluids. Send today for more complete information that will help you solve problems, improve designs. Dept. 064.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

CLEARING O. B. I.'s RATE A+ FOR RUGGEDNESS



This automobile door arm of ⅝" carbon steel is typical of the heavy duty jobs turned out by Clearing O. B. I.'s.

"No maintenance in two years", is one of the comments about a Clearing O. B. I. at this leading midwestern job shop. Their sixteen Clearing O. B. I.'s range from 45 to 150 tons capacity. They are used primarily to produce heavy duty automobile trunk and door components. It's rough work, but that's the kind these Clearing inclinables were designed for.

Clearing O. B. I.'s are built to true machine tool standards. Operation is smooth; operators like them. In addition, they are available with all controls built-in, everything in place and ready for fast, simplified installation.

Why not see for yourself? Write for Clearing's O. B. I. Catalog. We'll send it promptly. No obligation.

CLEARING PRESSES

the way to efficient mass production

CLEARING MACHINE CORPORATION *division of* **U.S. INDUSTRIES, INC.**

6499 W. 65th Street—Chicago 38, Illinois / Hamilton Division, Hamilton, Ohio

incurring a long-term debt, the full amount or even any part of which may not be needed for the entire period the obligation runs. They know that with a commercial finance company they have a flexible arrangement, their borrowings fluctuating from day to day as their needs require, and that they pay only for funds in actual use, not on amounts lying idle in the bank; hence, cost is reduced.

Commercial finance companies also make available plans for financing the acquisition of new machinery and equipment on a time payment basis. The period over which the purchase price is paid varies with the type of equipment and its useful life. Often payments may be so geared as to equal the amount recovered each year as a charge to depreciation.

Outlook for Commercial Financing in 1958

By William J. Drake
Executive Vice-President

National Commercial Finance Conference, Inc.

SINCE the Gross National Product is now running at an annual rate of close to $435 million, commercial financing and factoring executives see no slackening in the demand for essential business loans on a secured basis. Financing of open accounts receivable, imports and exports, industrial and commercial equipment, business inventories, Government contracts, and specialty loans are expected to continue at a high level in 1958.

Further advances in such newer fields as financing of equipment leasing plans, motion picture and television programs, budget accounts, and rediscounting of installment-loan transactions are anticipated this year. Particular gains are expected in the demands for funds for expansion and modernization of plants and equipment.

Accounts Receivable Financing

Accounts receivable financing, or the financing of open-book accounts of mercantile concerns, has found

increasing favor with small and medium-sized businesses. The commercial finance industry believes that there will be a greater demand for this form of financing than ever before in 1958, especially by companies that are inadequately financed or do not have a flexibility of credit to keep pace in a highly competitive market.

The newly established or growing concern will also find accounts receivable financing attractive from the standpoint of speed of accommodation and quantity of funds advanced. Such well-known concerns as Monsanto Chemical Co., Dow Chemical Co., Continental Motors Corp., and National Airlines, are examples of but a few which, at an early stage of their growth and development, profited from the use of commercial finance and factoring funds and services.

Equipment Financing

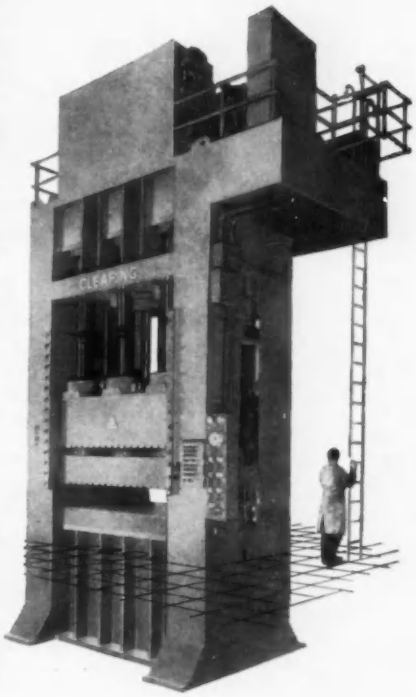
Funds for financing commercial and industrial equipment are in sizable demand again as businessmen look for more efficient and lower cost methods to meet competition. The various plans of the commercial finance and factoring companies, which enable the individual purchaser to pay for machinery on a scheduled basis, out of income that the machine itself will produce, will meet with ready response.

Manufacturers and distributors of all forms of equipment will find that they cannot permit substantial amounts of their funds to be tied up in customers' installment paper. The plan offered to manufacturers and distributors by commercial finance and factoring companies, of discounting or purchasing their installment paper, will appeal to large numbers of them.

The specialized services of the commercial finance and factoring companies, which are in addition to supplying funds, will be availed of to a greater extent in 1958 than previously. Manufacturers and distributors are not in a good position, economically, to perform the functions of credit investigations and collections. The commercial finance and factoring companies have built up credit files, evolved techniques, and developed large

THIS DOUBLE ACTION HYDRAULIC

MAKES JOB CHANGING EASIER



Clearing engineers have taken a lot of the struggle out of job changing on this 2,000 ton double action hydraulic press. Push buttons adjust the distance between the main ram and the blankholder. In addition, the blankholder has automatic sliding spacer bars which quickly change the size of the blankholder opening. There are also automatic die lifters which raise the dies off the bolster for fast removal. These are just a few details, of course. We have a lot more facts on this and other hydraulic presses that may be helpful to you. Write or call us.

SPEED UP YOUR PRODUCTION WITH A

CLEARING Hi-Speed Press

Here's a speedster that's engineered especially to get the most out of your expensive progressive dies. Special, beefed up frames insure precision in the stampings—less frequent die regrinds and consequently, longer die life. Find out about the presses that can speed up your schedules as well as give your dies maximum protection—the Clearing Hi-Speed Press. Capacities—50 through 200 tons. Speeds to 300 SPM.

Write for descriptive literature.

CLEARING PRESSES

the way to efficient mass production

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and well-trained staffs to whom this work is largely second nature.

Inventory Financing

The history of this form of financing shows that for many years about the only inventory loans made were those secured by commodities listed on the commodity exchanges. The commercial finance and factoring companies removed the bars to this ready means of financing through the application of the security devices of trust receipts, factors' liens, or field or public warehouse arrangements. It is a rare product or commodity, today, either in a finished or raw-material state, that does not lend itself to this form of financing.

The commercial finance and factoring industry believes that the field of inventory financing will undoubtedly expand in 1958 as the demand for working capital funds reaches new heights, and, particularly, as competition stiffens.

"PONY POWER" MOTORS

that give stamina to your products

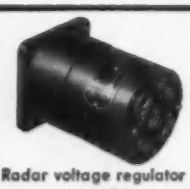
Lamb Electric ***fractional*** horsepower motors, like the small horses of the famed western-pioneer-day Pony Express, are developed for *stamina.*

Their dependability, and efficiency (optimum weight-size-horsepower ratio) are qualities that result from proper design and careful manufacture by personnel with many years of experience in the small motor field.

May we demonstrate how Lamb Electric Motors can bring these advantages—and also perhaps lower costs—to *your* products?

THE LAMB ELECTRIC COMPANY • KENT, OHIO
A Division of American Machine and Metals, Inc.
In Canada: Lamb Electric — Division of Sangamo Company Ltd.— Leaside, Ontario

Lamb Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS


Radar voltage regulator gear motor.

A rugged high-torque, high-speed motor.

Motor with efficient spur gear speed reducer.

AIR BRIEFS

(*Continued from page* 100)

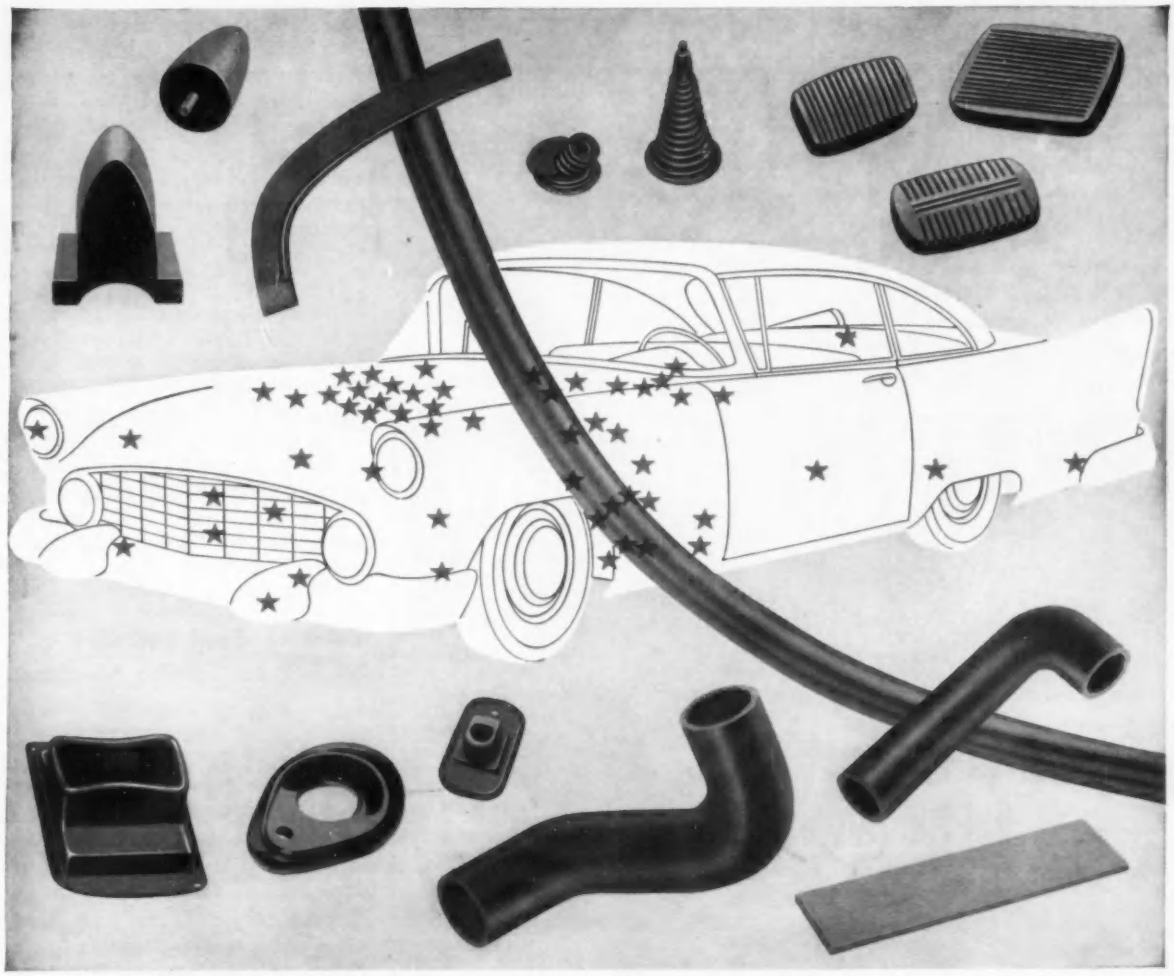
A large factor in providing for economical operations of jet transports is that it is necessary for them to spend a minimum of time on the ground between stops and turn-arounds. The Civil Aeronautics Administration has made recommendations to the airlines to facilitate the servicing of the jet aircraft. These recommendations seek to eliminate, as far as possible, trucks on the ramps and to provide special equipment to speed-up servicing of the aircraft at the airports.

North Atlantic Traffic Exceeded Million Passenger Mark for 1957

Scheduled airlines flying the North Atlantic loop established a new record by carrying approximately 1,023,000 passengers across the North Atlantic during 1957. It was the first time that the total annual passenger traffic between North America and Europe broke the million mark.

The passengers carried across the Atlantic in 1957 showed an increase of 10.8 percent over the number carried in 1956. Since 1948 the number of transatlantic passengers has increased four times. The figures above reported are scheduled airline members of the International Air Transport Association, consisting of Alitalia-Linee Aeree Italiane, Air France, British Overseas Airways Corporation, Canadian Pacific Airlines, Deutsche Lufthansa (DLH), El AL Israel Airlines, Iberia Airlines of Spain, KLM Royal Dutch Airlines, Pan American World Airways, QANTAS Empire Airways, SABENA Belgian World Airlines, Scandinavian Airlines System, Seaboard & Western Airlines, Inc., Swissair, Trans-Canada Air Lines, Trans World Airlines.

Readers of
AUTOMOTIVE INDUSTRIES
are always well informed



★ some of the more than 100 places where ENJAY BUTYL works, silently and dependably, helping to improve the performance of today's new cars.

ENJAY BUTYL—fabulous all-weather rubber BOOSTS PERFORMANCE IN '58 CARS

Molded into more than 100 parts, this super-durable, all-weather rubber helps provide a steadier, softer, more silent ride under even the most strenuous conditions of stress, weather change, and abrasive action. The dependability of all these parts contributes to the outstanding performance of the modern car.

Readily available in non-staining grades, Enjay Butyl rubber can be compounded into white and light-colored parts that combine beauty with top-notch performance. Low in cost, it out-performs and out-lasts all other rubbers formerly used, and may well be able to *cut costs* and *improve performance* in *your* product. For further information, and for expert technical assistance, contact the Enjay Company.

ENJAY BUTYL

Enjay Butyl is the greatest rubber value in the world . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY

Pioneer in Petrochemicals

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

(*Continued from page* 115)

transmitted to the output shaft.

Hydraulically-operated clutches are employed, and they are operated sequentially in various combinations to transfer the flow of power between the planetary differentials. The design of the gearing within the drive is such that infinitely-variable speeds of the output shaft are produced with no noticeable output speed drop below the selected speeds, throughout the entire range from 0 to 1800 rpm.

Sequential shifting of the clutches is controlled by a system that insures the engagement of a power transferring clutch prior to the disengagement of the clutch from which the power is being transferred. A servo mechanism is employed in the control system to give a positive speed relationship between the hydraulic units and the planetary differentials and thus provide synchronous speed for clutch shifting.

Prony-brake tests have shown an operating efficiency of from 87 to 92 per cent for the 40-hp prototype in the range from 130 to 1800 rpm. It has also been determined that a maximum of only 15 per cent of the output horsepower is transmitted by the hydraulic units; and that during most of the operating time the hydraulic units are employed to only about 25 per cent of their rated capacity.

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WRITE FOR COMPLETE INFORMATION

Machine Tool Builders All Set for Spring Meeting

As we go to press, plans have been finalized for the 56th Spring Meeting of the National Machine Tool Builders' Association. "World Trade and Machine Tools" is the theme for the meeting which is to be held in Chicago on Thursday, April 24, and Friday, April 25.

Speakers on the program who will discuss various aspects of this theme—of vital concern to U. S. builders of machine tools—will include representatives of Government. C. Douglas Dillon, deputy under-secretary for economic affairs, Department of State, will speak on the "World Trade Program." Senator George W. Malone (Nev.) will expand this subject in covering the "Effects of the World Trade Program." Several NMTBA member company officials will give the audience the benefit of their personal experiences in making on-the-ground studies of European industry and in locating production facilities abroad.

Distributors of Machine Tools Told Future Is Bright

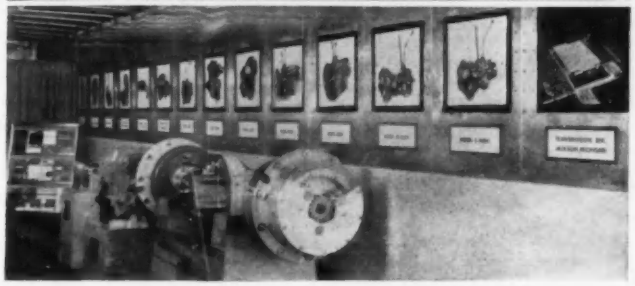
Confidence in the ability of the machine tool industry to snap back from the low business level of the past few months was voiced at the 34th Spring Meeting of the American Machine Tool Distributors' As-

TORQUE TALK FROM CLARK EQUIPMENT

CLARK COMPONENTS ON 7,000-MILE ROAD TOUR

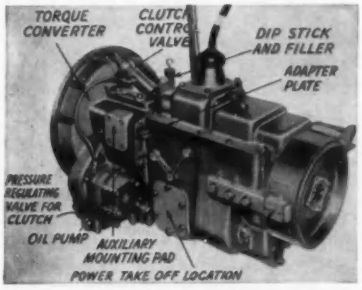
An on-the-spot demonstration of new designs to trucking operators, equipment builders and transport associations was the prupose of a 7,000-mile highway tour recently completed by Clark Equipment Company. Clark's Automotive Division fitted this "semi" rig with their latest ball-joint front suspensions, 10-speed StepMatic semi-automatic transmissions, and air-suspension systems for both truck drive and trailer tandem axles.

Clark officials felt no combination of charts, graphs and motion pictures could substitute for personal, behind-the-wheel tests in telling a transport expert how these products could improve his operation. For more details, cargo inside the trailer consisted of full-scale assemblies and cut-away models of the truck and trailer components, plus other Clark axle, transmission and torque converter designs for special-duty and off-road vehicles.



NEW POWER TRAIN FOR START-STOP SERVICE

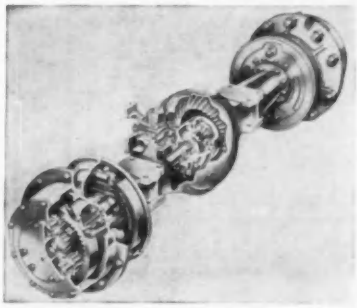
Clark Equipment Company's new TransVerter is ideal for such equipment as house-to-house delivery trucks, buses, garbage trucks and various types of construction machinery. Advantages include elimination



of engine stalling and lugging, sharp reduction in gear shifting, and fine inching control by simple throttle manipulation. The TransVerter can be installed by O.E.M. without major line re-design.

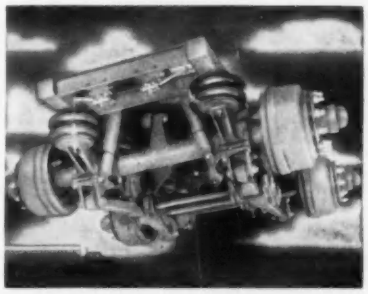
NEW AXLE LINE FOR OFF-ROAD EQUIPMENT

A new line of planetary drive and drive-steer axles, designed especially for heavy-duty vehicles, is now offered by Clark. Planetary drives at hubs puts final power multiplication at point of application; eliminates torsional "wind-up" in drive shaft; permits substantial size reduction in steering joint, axle shafts and differential—without sacrificing structural strength.



TONS OF CARGO FLOAT ON AIR

Damage to fragile or perishable highway cargo—and to empty trailers in transit—can be virtually eliminated by Clark's new Air Suspension. In this system, doughnut-shaped "air-springs" carry full weight of trailer and cargo, literally "floats" them over bumps with a ride approaching passenger car softness. Lateral roll and sway are minimized by an ingenious system of pivoted torque arms and torsion bars which take the full force of side loads and absorb torsion resulting from brake torque. Other advantages include automatic leveling of the trailer bed, lower maintenance costs and substantial weight reduction possibilities.



FOR YOUR READING RACK

NEW AUTOMOTIVE BOOKLET

Dramatic portrayal, in 24 pages, of Clark's basic line of automotive components. Includes illustrations of the Clark constant mesh and synchronized transmissions, TransVerter, StepMatic, power-shift transmissions, torque converters, agricultural units; also automotive driving and steering axles; planetary, industrial and trailer axles; air suspension assemblies; rear axle housings and electric steel castings.

CLARK FULL-LINE BOOKLET

A 48-page, full-color booklet in handy pocket size is your condensed guide to the entire product line of Clark Equipment Company. Automotive components, materials-handling equipment, construction machinery—all are described in concise detail. Basic information on the eight Clark plants and brief insight into corporate philosophy make this booklet a "must" for your reading rack.

FOR FURTHER INFORMATION

CLARK EQUIPMENT COMPANY

AUTOMOTIVE DIVISION

Buchanan or Jackson, Michigan

TransVerter and StepMatic are trade-marks of Clark Equipment Company

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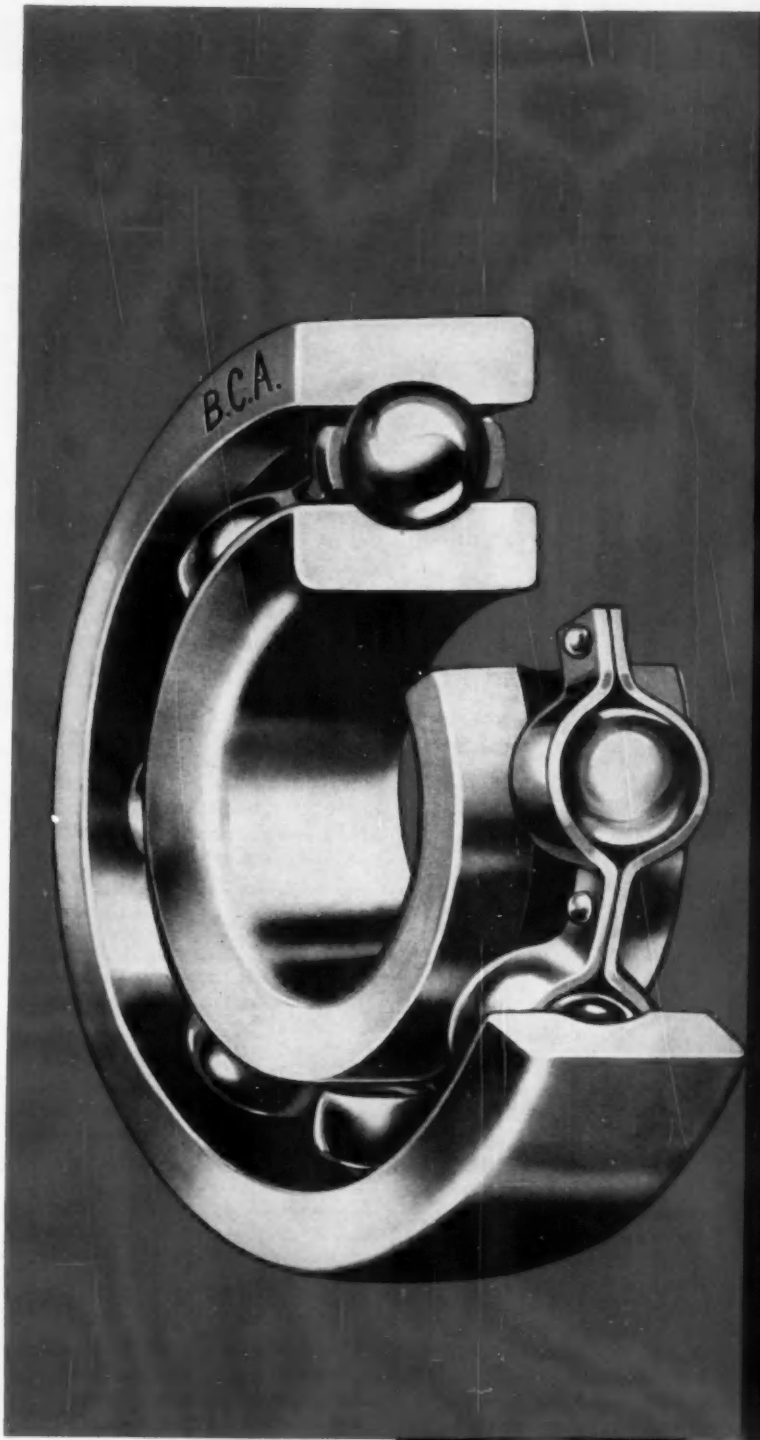
sociation held in New Orleans last month.

Frank H. Habicht, president of the association, indicated that what the industry needs is "renewed enthusiasm" to go out and sell in a manner geared to our expanding economy. He said, after reviewing statistics on the general economy and prospects, that "the opportunity definitely exists for a bright future if we are smart enough to cope with it."

"The greatest potential for new machine tool business this year," he stated, "is the dire need of all manufacturers to beat the price-cost, profit squeeze and obtain higher levels of output per man," adding, "a recent survey by the National Industrial Conference Board indicates that manufacturing executives recognize the need for improved tooling and increased mechanization to reach these goals." "Whether the upturn of machine tool orders occurs within one month, two months, or several months, is hard to predict," he said, "but beyond that, the longer term outlook is for further increases in the demand for our machines." Mr. Habicht predicted that "the time is not too far off when a billion dollars of sales will be considered a normal peacetime year for machine tools."

At the same meeting, future machine tool requirements as related to the missile and ballistics programs were outlined by Louis L. Gober, chief of the engineering branch, Industrial Operations Div., Army Ballistics Missile Agency, Huntsville, Ala. He pointed out that demands for more versatile and improved missile systems will undoubtedly accrue greater stresses on structural members and components. And that these factors, coupled with the need for weight reduction, will necessitate new and stronger materials—which, in turn, will generate a need "for the design and development of machine tools capable of machining these new materials, and, for specific applications, holding even closer tolerances than are now considered industry standards." He said that "as a major contributor in the continuing success of this country's programs, the American machine tool industry will be called upon to



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expend increased effort in development and application of new techniques and equipment." Adding, "continual demand will emerge from this country's missile programs not only for machine equipment to satisfy normal obsolescence and wear replacement, but also to fill the void being constantly created for tools-to-be: tools which will perform machining operations that are today unknown, on materials new to the metalworking industry or not yet developed."

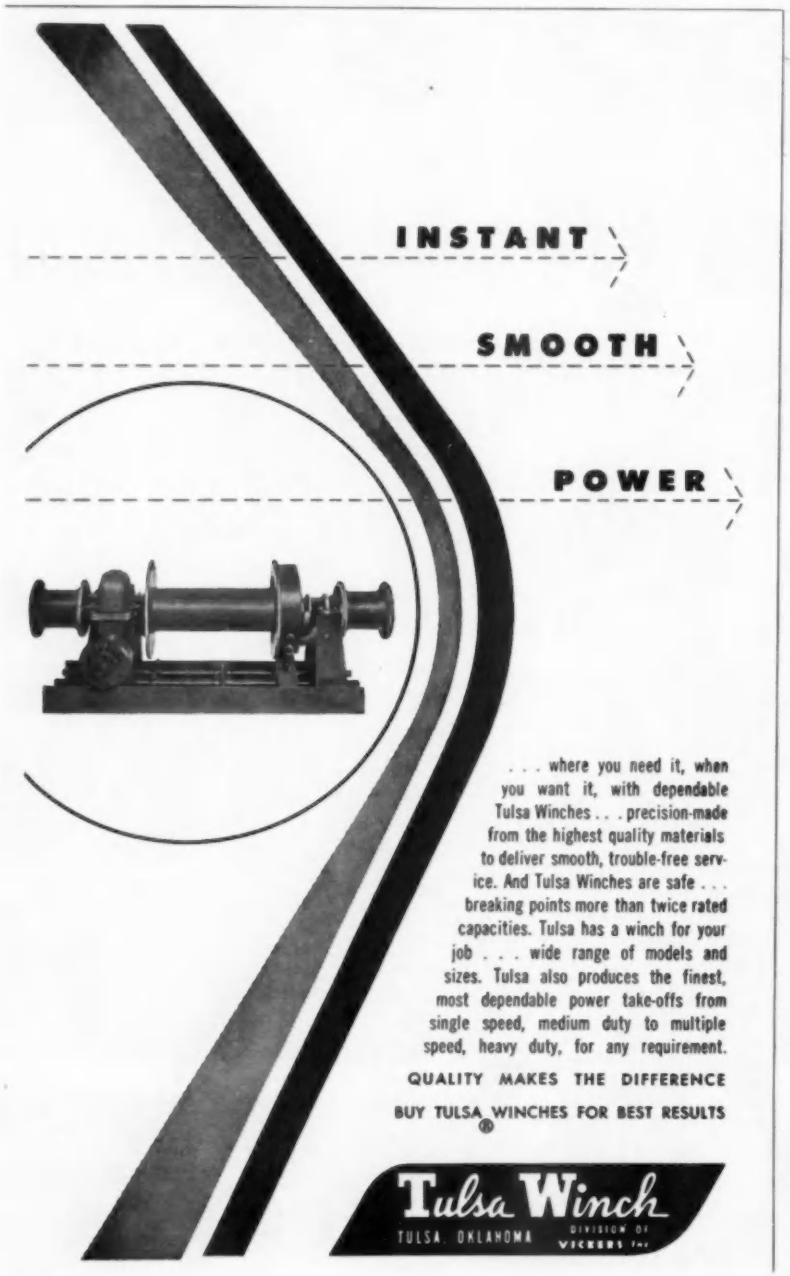
Trends in Construction Equipment

(*Continued from page 57*)

The Western Governors' Conference urged that all federal highway user taxes be placed in the Highway Trust Fund to keep the program on the 13-year schedule, and suggested that Hawaii be allocated mileage in the program.

Deere Expands

Deere & Co. has expanded facilities at its Dubuque works to make tractors, and has also expanded facilities at Moline to produce accessories. With the five new additions at Dubuque, a new power plant, and some remodeling, capacity will be increased 30 per cent. The expansion program will cost about $3 million.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An oil shale plant capable of mining and processing 3000 tons of oil shale per day could produce 2000 barrels of oil per day for 12 years from one square mile of Grand Valley, Col., shale beds.

●

Of all the oil wells completed last year, more than 78 per cent were owned and financed by small companies or independent operators.

●

Only 38 years ago, it took twice as much crude oil to produce a gallon of gasoline as it does today.

●

The USSR graduated a total of 71,600 engineers in 1956, compared with 23,000 graduated in the U. S. in 1955.

●

Two gallons of today's gasoline in automobile engines do the same work as three gallons of 1933 gas did at that time.

●

Americans spent almost $2 billion in 1957 for new and used boats, engines and accessories, safety equipment, fuel, insurance, docking, launching, storage, maintenance, repair, and boat club memberships.

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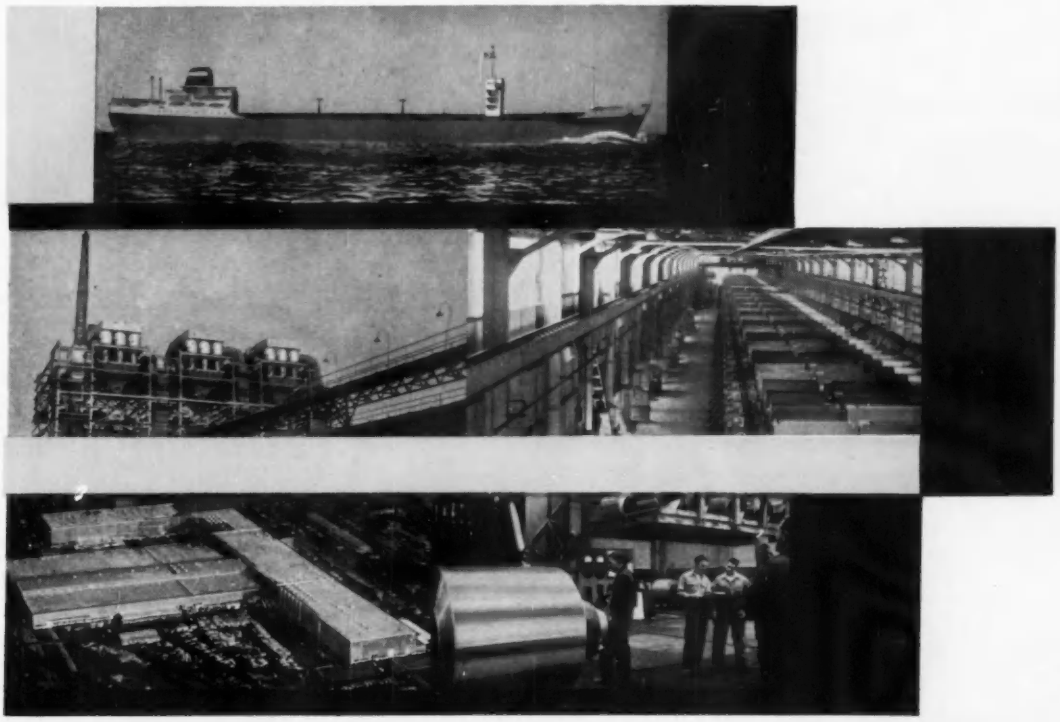

Demand for aluminum is way up in the auto industry. Increasingly, car makers are discovering the advantages of aluminum for their models. This fast-growing trend makes it wise for you to assure yourself of adequate future supply.

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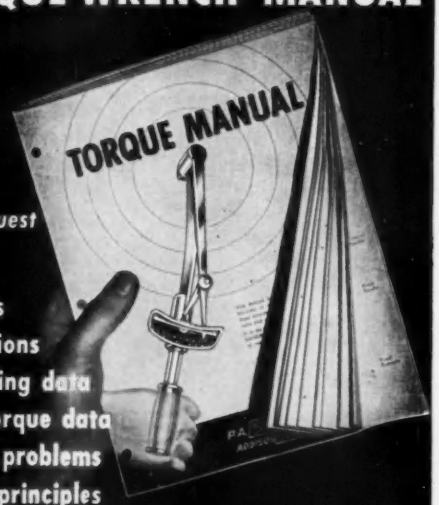

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Formulas
Applications
Engineering data
Screw torque data
Adapter problems
General principles

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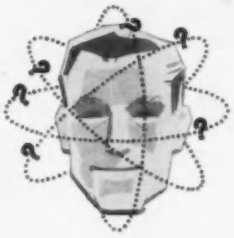


When you buy new hobbing machines, gear your thinking to the future.

It is not enough just to meet today's production requirements. The machines you buy now must have "built-in" features that will measure up to the high-speed production demands of tomorrow.

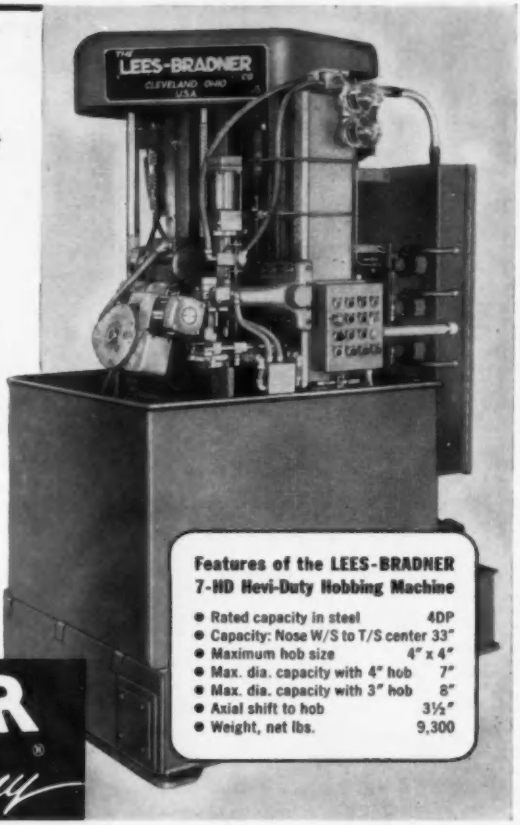
The Lees-Bradner Company manufactures a complete line of hobbing machines designed to fulfill varied requirements.

For example, this 7-HD Hevi-Duty Single Spindle Hobbing Machine is built to hob *today* at *tomorrow's* higher feeds and speeds. It's a heavy, powerful machine equipped with a new hob head featuring an axial shift of 3½ inches.

The 7-HD is also available in 4 and 6-spindle rotary models.

For complete technical information on Lees-Bradner "years ahead" Hobbing Machines send for your free 7-HD brochure . . . or contact the Lees-Bradner representative in your area.

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER



Features of the LEES-BRADNER 7-HD Hevi-Duty Hobbing Machine

- Rated capacity in steel 4DP
- Capacity: Nose W/S to T/S center 33"
- Maximum hob size 4" x 4"
- Max. dia. capacity with 4" hob 7"
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- Axial shift to hob 3½"
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No more costly, time-consuming delays . . . new strategic-area stocking program means that any standard Westinghouse resistance welding control, combination or individual timers, can be shipped and on its way to your plant within 24 hours.

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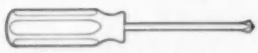
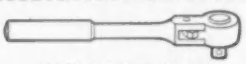


NEW! 2½ Inch Blade #0 Phillips Bit Midget Screwdriver



NEW! 4½ Inch Midget Reversible Ratchet

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ON OUR WASHINGTON WIRE

Congress is moving dangerously close to a wide-open defense spending spree. In their haste to get new Federal money into circulation at local levels, congressmen of both parties are approving orders for the Pentagon to start some military projects of little or no strategic value.

Some Pentagon officials are saying in private that the present wave of uncontrolled military spending may be just as harmful as last year's cutbacks in spending authorizations.

Loose talk of tax cuts is causing some damage to retail trade. Car sales, for example, fell off sharply following demands of automobile manufacturers for removal of the Federal excise tax on new passenger cars. Detroit management is now telling Congress either to kill the 10 per cent excise or to publicly announce that it won't be removed so as to clear up doubts in the minds of potential buyers.

Shifting defense emphasis from conventional to missile-atomic age weapons is steadily shrinking the number of plants in the military industrial reserve. Navy will close 18 more plants in fiscal year beginning July 1. In the current year, 96 were closed.

Three factors still mitigate against a tax cut. First, while it might restore consumer confidence for a little while, it wouldn't put more than $1 to $3 a week in most family paychecks. Second, the loss of revenue would hurt the current military missile and conventional arms buildup. And third, it would be inflationary.

Army and Navy ambitions for development of land-based strategic missiles are being doused by order of Defense Secretary McElroy. Missiles built to fire 1500 miles and more are to be worked out entirely by the Air Force, he tells the other services.

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BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
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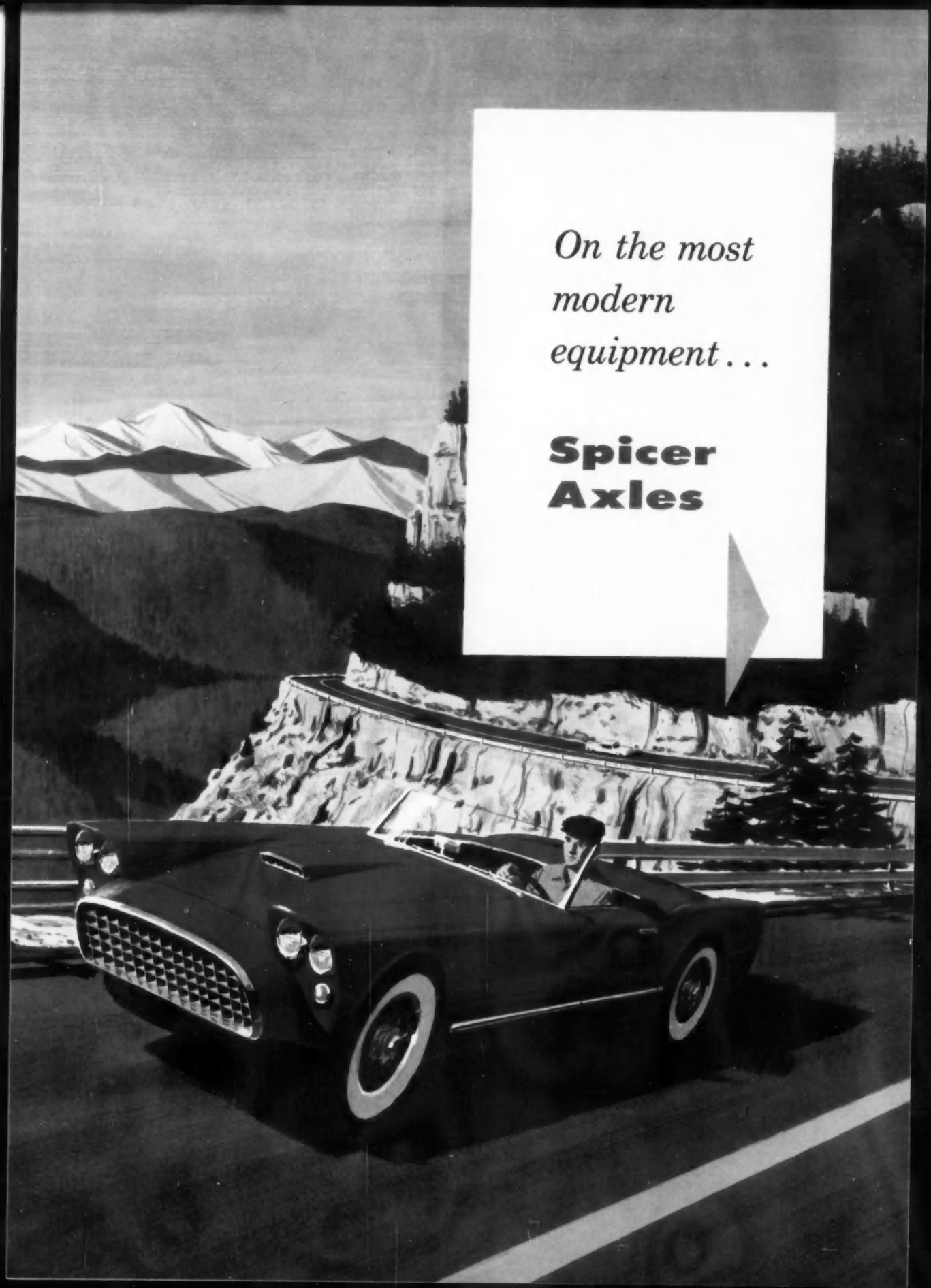
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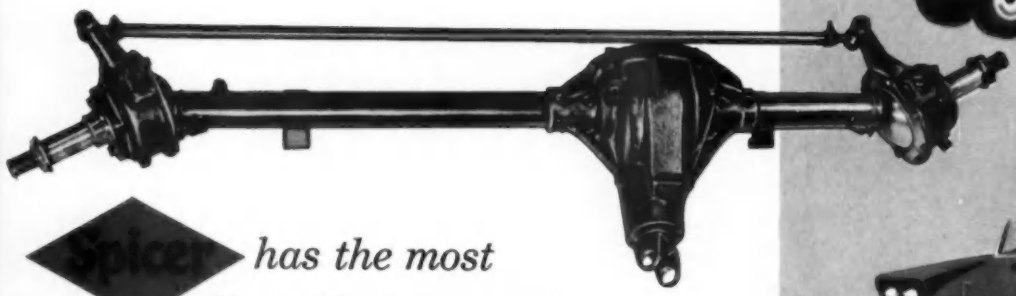

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Many of these products manufactured in Canada by Hayes Steel Products Limited, Merritton, Ontario

DANA
Spicer

New Static Switches Revealed at Westinghouse

(*Continued from page* 69)

rated for use in particular devices, and samples are tested for electrical characteristics to confirm their suitability for the individual application. They are also checked for proper physical thickness. After fusing, the diodes are tested for forward and reverse voltage characteristics. Before being accepted for further processing on the encapsulation line, fused diodes must additionally have a satisfactory reverse leakage at 150 C.

New Product Developments

A semiconductor rectifier that can function in a temperature range up to 1300 F was among several new product developments announced at the plant unveiling. Made of silicon carbide, the rectifier was evolved by a team of Westinghouse scientists under a contract with the Electronic Components Laboratory of the Wright Air Development Center calling for a 932 F (500 C) rectifier for use in airborne electrical systems. The desired objective was obtained by utilizing improved methods for preparing ultra-pure silicon carbide crystals. The present technique is said to give near-perfect single crystals with impurities of less than one part per million.

Basically, the new high-temperature silicon carbide rectifier consists of a crystal of material which has been purposely "doped" by adding a small quantity of an impurity. The location at which the doped and undoped sections of the crystal meet is called a p-n junction —a point across which electrons flow in one direction much better than they do in the opposite direction. The crystal thus acts as a rectifier. It was stated that these "grown" junctions of silicon carbide will act as rectifiers capable of withstanding several hundred volts and passing up to 10 amp of current. Westinghouse spokesmen indicated that the grown-junction silicon carbide crystals are prepared in a specially-designed furnace operating at higher than 4500 F and containing an atmosphere of pure helium or argon.

Development of a new series of silicon power transistors, usable as d-c switches, was also revealed. Two types of n-p-n fused junction devices have been produced—a 2-5 amp unit that can handle power up to one kilowatt, and a 10-20 amp unit to handle power up to three kilowatts.

The first silicon power transistors produced have collector-to-emitter voltages of from 50 to over 300 v. Current ratings on these units range from two to five amperes, based on the current at which current gain is equal to or greater than 10. These relatively high voltages and currents, coupled with very low saturation resistances, permit use of these devices

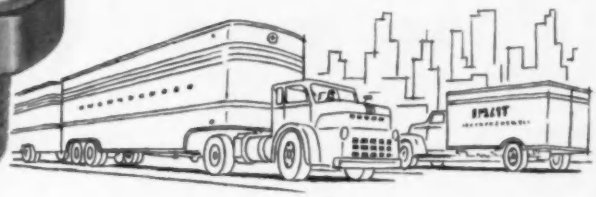
(*Turn to page* 154, *please*)

new

FASCO "455"

LOW AIR PRESSURE WARNING SWITCH

for Trucks and Tractors



Designed to meet the exacting, heavy-duty requirements of today's air brake systems, the new FASCO "455" Switch has been proved "right-for-the-job" by thousands of miles of actual road tests. Its operation is sure, dependable, and it performs its "watchdog" duty by activating a warning light or warning buzzer when the air supply falls below a safe operating level (approximately 60 p.s.i.).

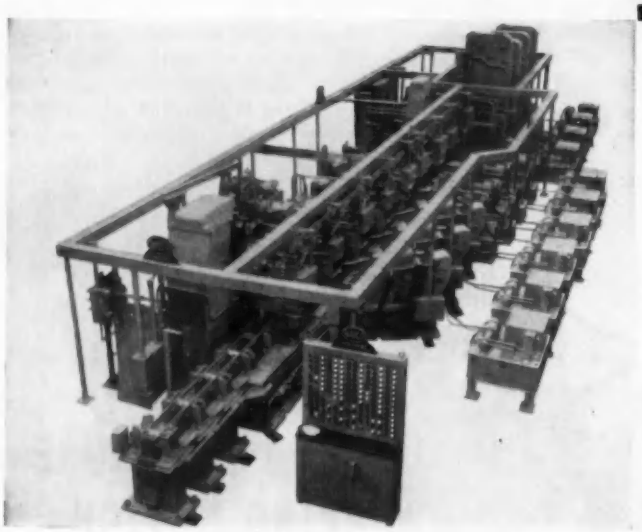
The rugged, compact design of the "455" permits it to withstand extreme pressure, equal to several times the available vehicle pressure. The all-steel, hex-shaped housing which is corrosion-protected, provides extra safety and makes for quick, easy installation. And here's a point to remember—the use of this switch is not limited to trucks and tractors. It can be adapted to any low-pressure application.

Samples and complete data available on request.

FASCO AUTOMOTIVE DIVISION
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK

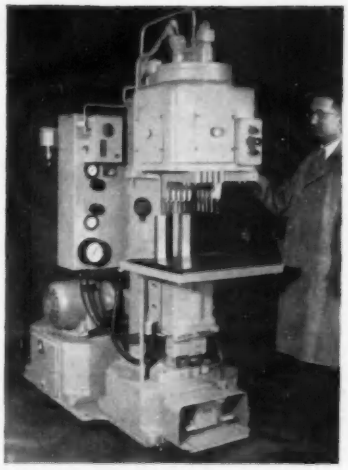
DETROIT OFFICE: 12737 PURITAN • PHONE: UN 17476

Only Builds



from transfer machines

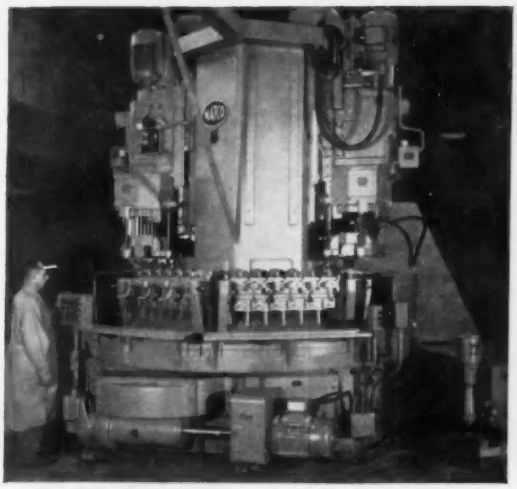
to small multi-spindles



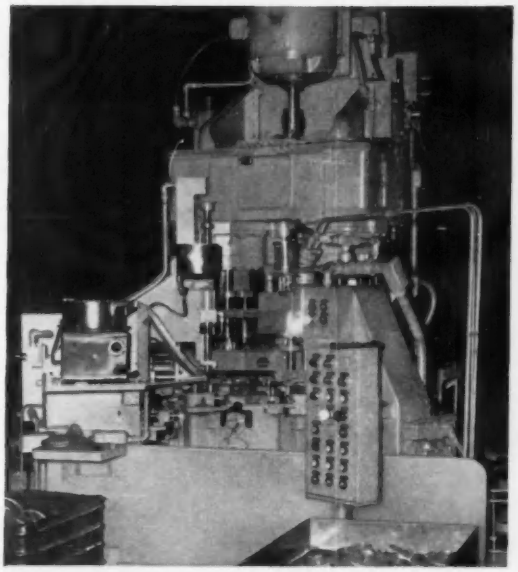
NATCO

Somewhere in Natco's experience is a money-saving idea for you!

Natco All Six



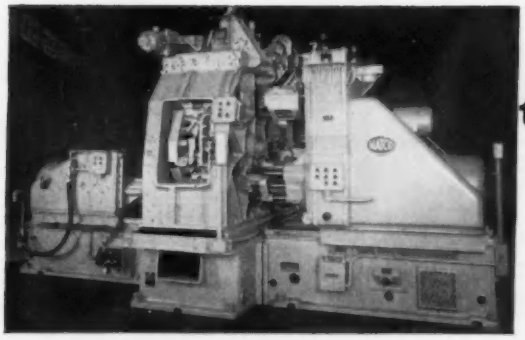
station

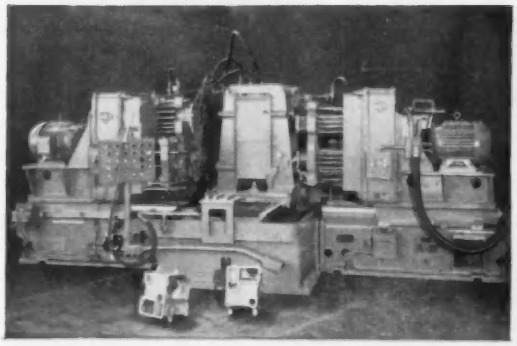


index

trunnion

way-type





...and everything in between

Drilling, boring, facing, tapping.

National Automatic Tool Company, Inc.,

Richmond, Indiana. Natco offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles: distributors in other cities.

New Static Switches

(*Continued from page* 151)

for power switching operations. Efficiency is very high. It was cited, for example, that as a d-c switch handling one kilowatt (200 v at 5 amp), the internal dissipation of the unit is about five watts, giving an efficiency of 99.5 per cent.

The principles used in developing the 2-5 amp transistor have been extended to produce a device capable of handling up to three kilowatts. Voltage ratings (collector-to-emitter) on present 10-20 amp units range from 50 to 150 v. Further development work is expected to increase the range to 300 v and about six kilowatts. Used as a d-c switch, the present 10-20 amp device can handle three kilowatts of power with internal losses of less than 20 w.

In addition to the foregoing, company scientists have developed silicon switches, called Trinistor silicon triodes, capable of blocking up to 200 v and carrying currents up to 10 amp. Westinghouse is investigating the extension of current control to the 100 and 200-amp range using this new silicon switch structure. It was also stated that selected laboratory samples of these devices have indicated the possibility of blocking voltages as high as 1000.

Spin-Finish

Replaces hand and automatic buffing!

- One-operation finishing of most complex parts
- Completely dry process . . . no lubricants
- Dust and fume free . . . no exhaust systems
- No set-up time required

Wipe the slate clean of all present concepts of speed, efficiency and costs in pre-plating finishing of brass, zinc-base and aluminum die-cast parts! In one short, automatically-timed operation—and on a *multiple mounting* of parts—new SPIN-FINISH produces surfaces and lustre equal to or surpassing that of buffing. Write for information.

GRAV-I-FLO CORPORATION

Dept. AI-4A 400 Norwood Avenue, Sturgis, Michigan

Continental's Fuel Injection

(*Continued from page* 60)

drilled for passage of fuel from the diaphragm chamber to its base, and the previously described ball valve is installed within the plunger.

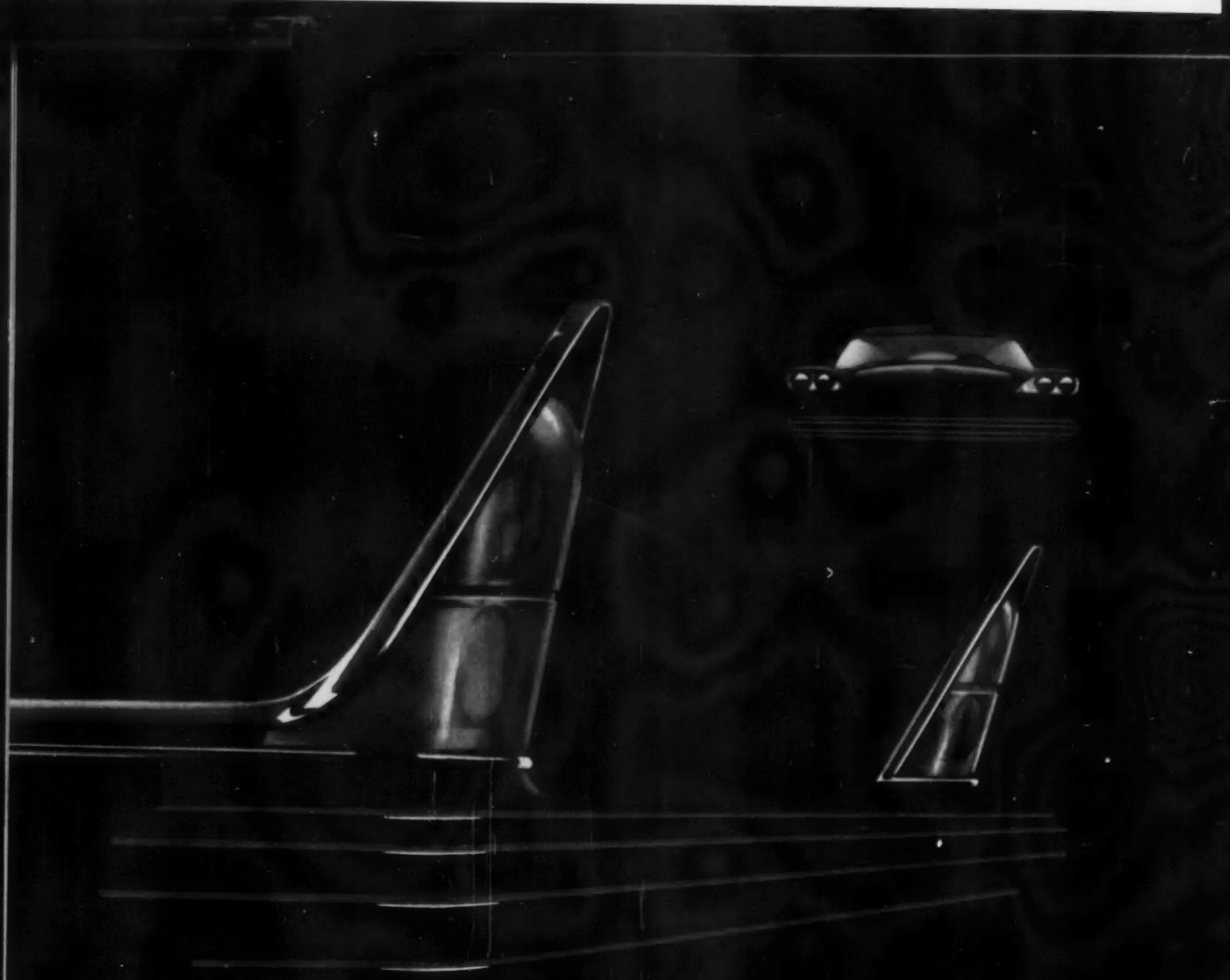
FIG. 7

The fuel discharge nozzle is located in the cylinder head, with its outlet directed into the intake port. The nozzle body contains a drilled central passage with a counterbore at each end. The lower end is used as a chamber for fuel-air mixing before the spray leaves the nozzle. The upper bore contains a removable orifice for calibrating the nozzles.

Near the top, radial holes connect the upper counterbore with the outside of the nozzle body for air admission. These holes enter the counterbore above the orifice and draw outside air through a cylindrical screen fitted over the nozzle body which keeps dirt and foreign material out of the interior of the nozzle. A press-fitted shield is mounted on the nozzle body and extends over the greater part of the filter screen, leaving an opening near the bottom. Fig. 7 shows details of the fuel discharge nozzle.

Idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. The idle mixture adjustment is the locknut at the metering valve end of the linkage between the metering valve and air throttle levers. Tightening the nut to shorten the linkage provides a richer mixture. A leaner mixture is obtained by backing off the nut to lengthen the linkage.

In addition to the system as



offer rustfree beauty...
save weight... increase
design freedom

The Finest Products
Made with Aluminum

REYNOLDS ALUMINUM

Aluminum's flexibility

in design, fabrication and finishes, offers a variety of sales appealing bumper ideas

Consider these aluminum bumper advantages:

- **Styling and design versatility.** With aluminum you are not limited to one finish—there are attractive new textures and finishes including clear and color anodized combinations with the "look of sterling" and "the gleam of gold". Contrasting colors can also be added through the use of organic finishes. And, paint films adhere to anodized aluminum remarkably better than to other materials used for decorative applications.
- **Long lasting beauty and economy.** Aluminum bumpers cannot rust—ever. Anodizing solves corrosion problems even with deep recesses that cannot be plated economically. Economy results from original production savings and reduced warranty costs.
- **Lighter weight.** Aluminum cuts "overhang" weight, can reduce total bumper weight by one-half, gives brakes less load to stop.
- **Fabricating savings.** *Extruded* aluminum bumpers, for example, can slash bumper tooling costs. Reinforcing members integral with bumper itself can be designed into either side for strength or beauty. If desired for style reasons, grooves also can be extruded for inserting bumper faces of other materials and colors. *Stamped* sheet aluminum bumpers can cut finishing costs—eliminate need for many finishing operations required with other metals.

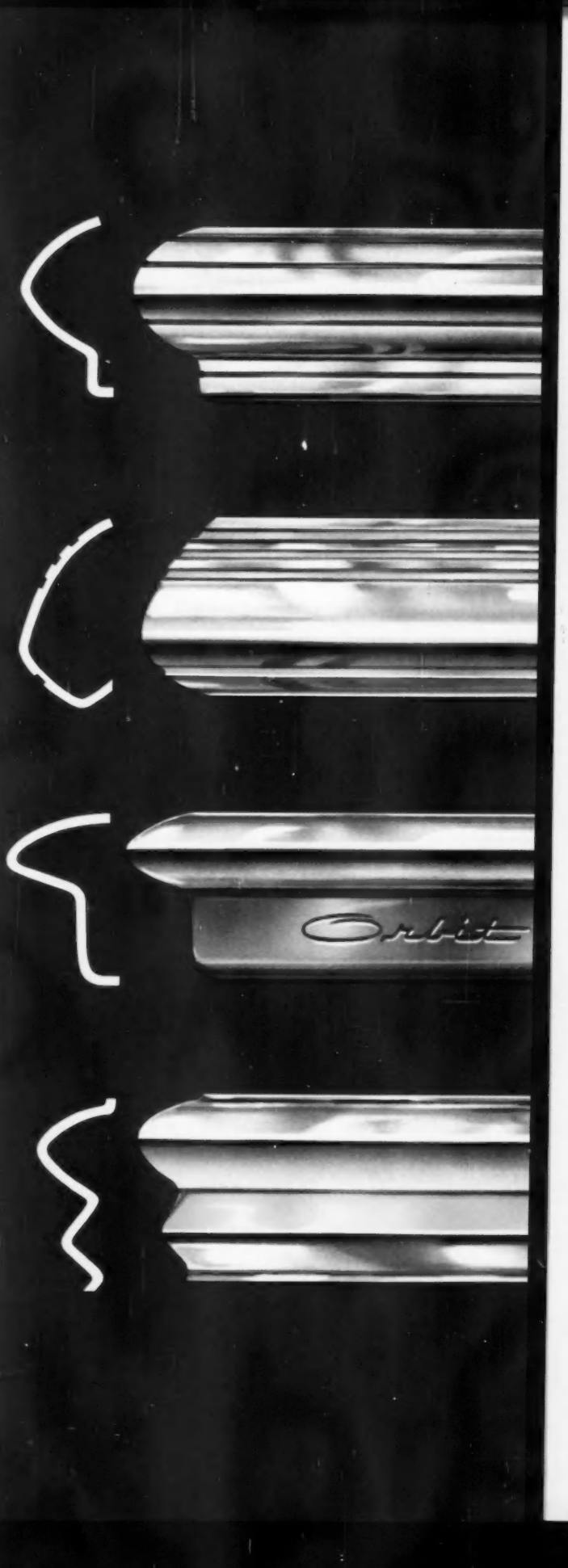
On this application and on countless others, Reynolds Aluminum Specialists will be glad to work with you to help you get the very most from the aluminum you use. For details on this service and on aluminum mill products or fabricated aluminum parts and trim, call your nearest Reynolds Office. Or write *Reynolds Metals Company, Fisher Building, Detroit 2, Michigan or P.O. Box 1800-MY, Louisville 1, Kentucky.*

NOTE: Before you buy any part—have it designed and priced in aluminum. Basic material costs do not determine part costs. New techniques and processes—applicable only to aluminum—can give you a better product at a lower *final* cost.

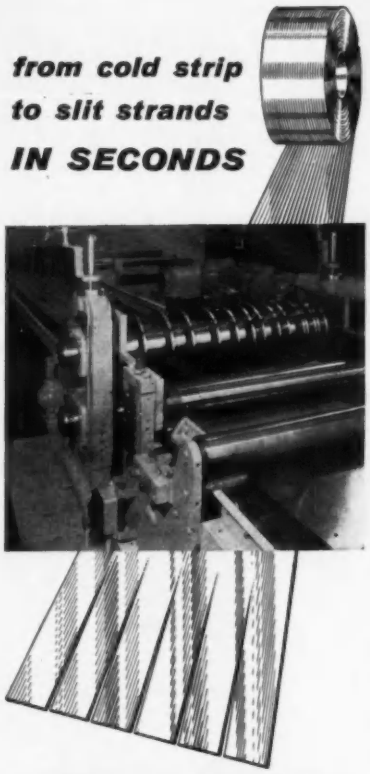
The Finest Products Made with Aluminum
REYNOLDS ALUMINUM

Reynolds Aluminum
the metal for *automation*
TRADE MARK

Watch Reynolds All-Family Television Program, "DISNEYLAND", ABC-TV.



from cold strip
to slit strands
IN SECONDS



YODER ROTARY MULTIPLE SLITTERS

A Yoder slitter converts mill-width coils of flat-rolled metal into many variable-width strands in amazingly short time. Speed, coupled with great accuracy and low manpower requirements, makes a Yoder slitter an important factor in keeping production and overhead costs down.

Operated by only two men, the Yoder Type 3-48 slitter illustrated is designed to accommodate standard mill-width coils up to 48 inches wide, in a variety of metals and thicknesses. The slit strand widths can be held to within a .004" tolerance.

Even if your steel requirements are as little as 100 tons a month, the savings to be realized in time, manpower and raw material costs alone will pay for a Yoder slitter in the first few months of operation.

There is a Yoder slitter designed and engineered to meet your requirements, and to speed the delivery of "special" width stock in a wide range of large or small sizes. Send for your free copy of the fully-illustrated, 76-page booklet, "Multiple Rotary Slitting Lines."

THE YODER COMPANY
5553 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
ROTARY SLITTING LINES

supplied by Continental Motors, the usual fuel tank, feed lines and valves, and fuel filter are required. The metered fuel pressure gage is supplied by the aircraft manufacturer on the instrument panel as are the mixture and throttle controls. As with all engine-driven pump installations an auxiliary pump is needed for fuel pressure in starting the engine. It also provides an alternate source of fuel pressure for the injection system for maximum safety.

The BUSINESS PULSE

(*Continued from page* 96)

good a chance, if not better, that consumer purchases will decline further in future months as there is that they will increase.

Modest Inventory Liquidation

It is now clear that inventory liquidation, as measured by change in book value, was relatively modest in the closing months of 1957. On a seasonally adjusted basis, total manufacturing and trade inventories stood at $90.7 billion at the year's end, only $600 million or well under 1 per cent below their peak last summer. The decline was accentuated in January and February and presumably continued at a substantial pace during March. Even so, there can be no doubt that total inventory liquidation so far has been much smaller, both in dollar terms and percentagewise, than was total liquidation during the full length of the 1949 and 1954 recessions. Inventory reduction could continue from now through

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MANUFACTURING

MARKING METAL?
Blaisdell Markers write on anything.

CHINA MARKER
Ideal for bold, bright marking on all slick surfaces. Strong and durable . . . adheres firmly . . . 14 vivid colors.

GET THESE BLAISDELL EXCLUSIVES:

SPEE-D-POINT Perforation makes easy sharpening.

STED-D-POINT Staple secures lead.

Write for sample naming this publication. Our many special pencils have solved varied marking problems since 1893. Let us help you.

TRADE MARKS REG. U.S. PAT. OFF.

BLAISDELL PENCIL COMPANY
BETHAYRES, PENNA.

O-RINGS

CUSTOM MOLDING • CUSTOM COMPOUNDING

If you're looking for O-rings to perform under today's greater temperature ranges, higher pressures, and other severe conditions, look to Goshen. Here custom compounding of natural, synthetic and silicone rubbers is performed by experts in developing the exact combination of properties required in *your seal*. GRC O-rings are available in a complete range of AN, MS, SAE and JIC standard sizes, plus many non-standard sizes and special shapes. We'll gladly work with you in adapting to your application the correct GRC O-ring.

Ask for free copy of GRC O-ring brochure. 16 pages of useful information.

Goshen Rubber Co., INC.
2748 S. TENTH ST. GOSHEN, INDIANA

the end of July at the advanced January pace of $700 million monthly without resulting in a cumulative decline exceeding that which occurred during the 1954 recession. And since there are mounting indications that this recession is probably somewhat more severe than the earlier one, it is difficult to make the assumption that inventory liquidation will be milder.

With capital spending headed downward, with retail trade sluggish, and with inventory liquidation still very possibly having some distance to go, the assertion that the bottom of the recession is close at hand is not wholly persuasive. There are offsets in rising expenditures by Federal, State and local governments, but increases in these sectors do not seem sufficient just now to assure a balance immediately, although they probably can be expected to moderate the pace of decline. Even though the steepest phase of the downturn may be over, there remains the possibility of slow attrition for many months to come, with the final trough in general business perhaps delayed until late summer. This would imply little prospect of a significant upturn before the final months of the year.

Outlook for Rebound

If this proves to be the pattern, the declining phase of the recession will go down in the annals as having been roughly similar to the decline of 1953-54, probably a little greater in magnitude but approximately the same in duration. The question of recovery, however, is another matter. One reason that the 1954 experience is regarded as mild is the strength and rapidity of the subsequent recovery. This time the outlook for a similar rebound is far from clear. Consumers played the key initiating role in the 1954-55 recovery, but there must be some doubt that this will occur again in the same degree considering (1) the substantial additions which they have since made to their stock of durable goods and (2) their higher debt obligations. And whereas plant and equipment outlays rose sharply from 1955 on in response to the upturn in the consumer sector, corresponding strength this time also looks somewhat doubtful, given the apparently more burdensome problem of excess capacity which now exists.

These two differences could produce a more stubborn, drawn-out period of reduced activity this time, involving some problems of serious nature that were not present in the aftermath of the 1953-54 decline. For one thing, the hardship of unemployment could be more severe, even if there is no further rise in the total, since the longer a person is out of work the more precarious his position becomes as unemployment-insurance benefits are exhausted and savings are used up. There would also be the danger that public disappointment over the duration of reduced activity would weaken confidence and produce heightened spending caution, which is one good reason why it seems inadvisable today to stimulate expectations by looking only at the good side of things. Federal demand for goods and services may conceivably rise at a faster pace than is indicated by present tendencies.

For spring life everlasting...

NILCOR* ALLOY!

Nilcor alloy is not a steel! It is truly unique. It is believed to have no equal, for example, for continuous life in miniature springs. Further, it is non-magnetic and far outdistances steel or any known alloy in resistance to "set", fatigue and corrosion . . . even at high temperatures.

Major use to date is for non-breakable power springs in fine watches. But more and more Nilcor alloy is and will be furnished for the most critical requirements in instrumentation, control devices and equipment of many types . . . wherever extreme spring life and precise behavior are vital.

Perhaps National-Standard Nilcor alloy holds promise for some of your needs. We shall certainly be glad to cooperate *all* the way in helping you find out. Just check with our Athenia Steel Div., Clifton, New Jersey.

**Trade Mark National-Standard Co.*

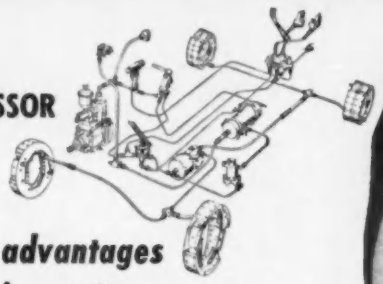
NATIONAL NS NATIONAL-STANDARD Company **STANDARD**

DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *fine wire, stainless, music spring and plated wires* • WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties* WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* ATHENIA STEEL, Clifton, N. J.; *flat, high carbon spring steels* • REYNOLDS WIRE, Dixon, Ill.; *industrial wire cloth*

Wagner AIR-OVER-HYDRAULIC Brake Actuation provides safe braking of heavy vehicles that use hydraulic foundation brakes

With the

WAGNER ROTARY AIR COMPRESSOR
...POWER CLUSTER
...FOOT VALVE



You give your customers the advantages of passenger car hydraulic braking systems.

- **SINGLE ACTION BRAKE APPLICATION** (eliminates uncertain two-stage feel)
- **LOW PEDAL OR TREADLE**
- **FAST APPLICATION AND RELEASE OF BRAKING PRESSURE DUE TO HIGH CAPACITY APPLICATION VALVE.**

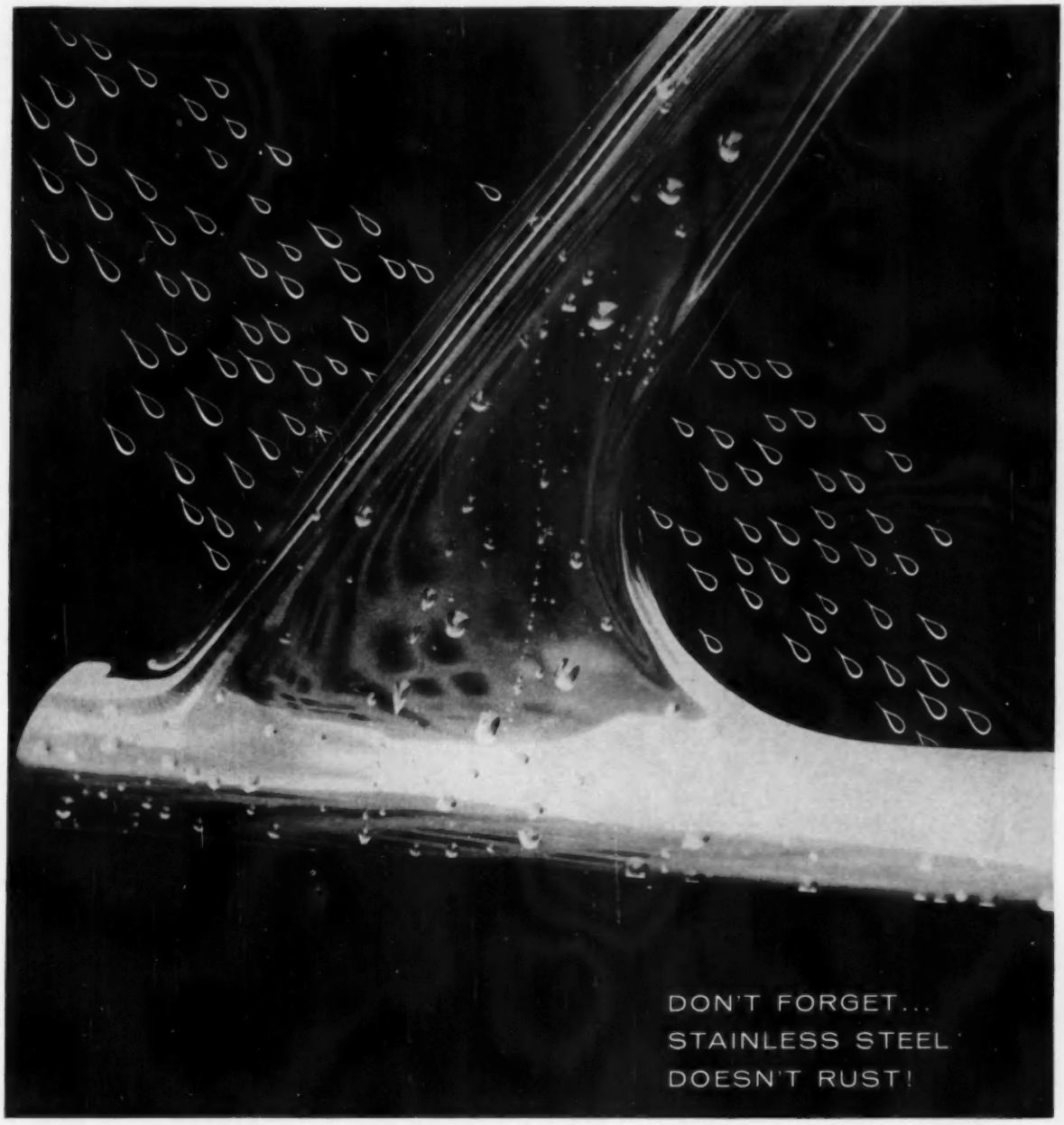
With 35 years of experience in manufacturing braking systems, Wagner is the *only* manufacturer producing *all* of the air and hydraulic components necessary for a complete air-over-hydraulic power brake system. The vehicles you manufacture will be safer when they are equipped with Wagner Air Brake Systems – the systems with the *Rotary* Compressors.

Get the whole story on Wagner Air-Over-Hydraulic Systems—first in economy, reliability and safety.

SEND FOR CATALOG KU-201. It points out the many advantages you gain with Wagner Air-Over-Hydraulic actuation on all your vehicles equipped with hydraulic foundation brakes.

WK58-A

Wagner Electric Corporation
6363 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U.S.A.
(Branches in principal cities in U.S. and in Canada)



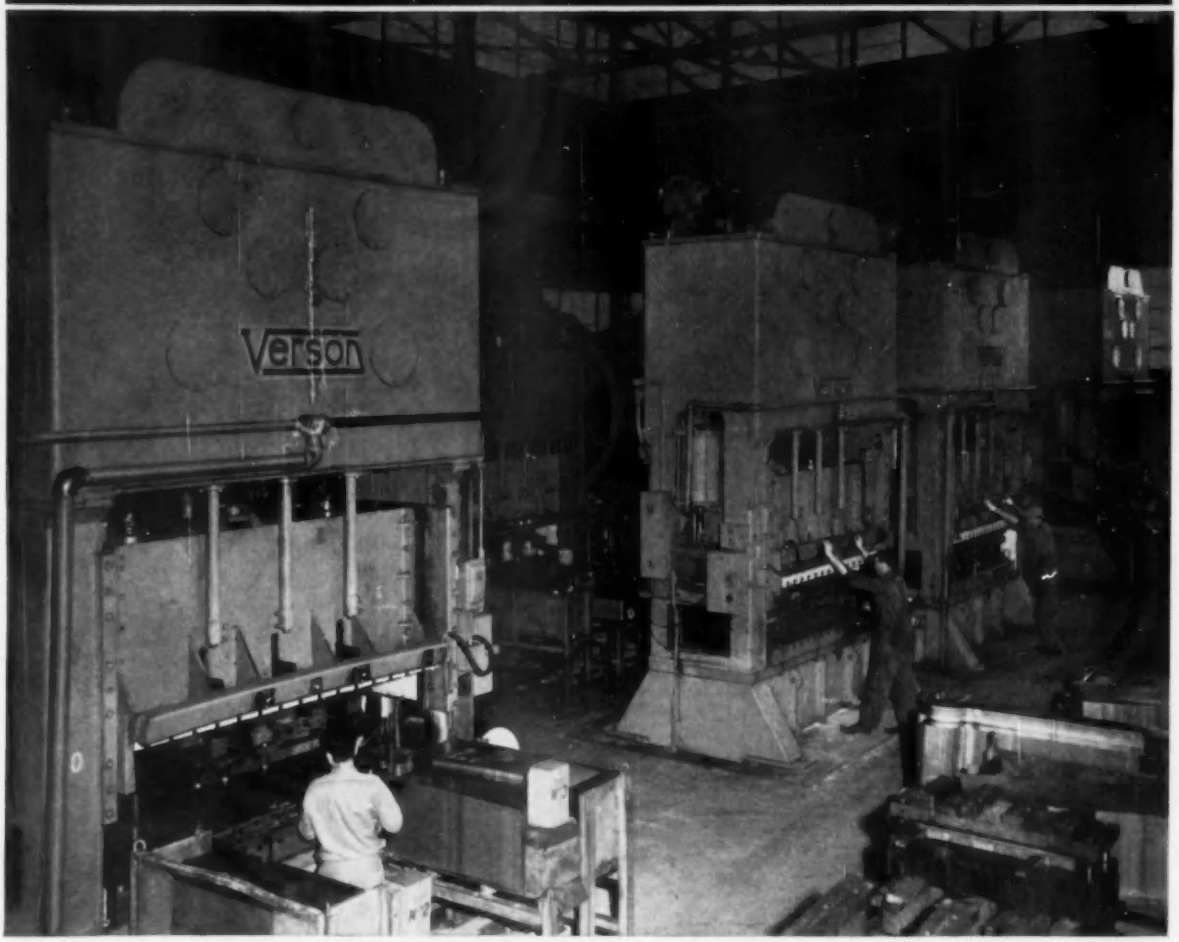
Yes—everybody knows that. Yet it's still good to remember when you're thinking of auto trim and parts. For it's a basic reason why over 50% of all America's new car buyers prefer stainless! Car buyers know, too, that stainless helps cars bring more in resale, because stainless doesn't dent like other metals, resists scratches and road chemicals, and comes up bright as new with simple soap-and-water washing! So remember stainless—it adds so much, at so little cost. And remember, too, the best stainless steels are made with Vancoram Ferro Alloys! Vanadium Corporation of America, 420 Lexington Avenue, New York 17, New York.

Producers of alloys, metals and chemicals

VANCORAM

VANADIUM CORPORATION OF AMERICA

To make manufacturing more efficient . . . more profitable . . .



Another versatile production process engineered and developed by Verson

To achieve a more efficient, more flexible metal-working plant, Lobdell-Emery Mfg. Co., Alma, Michigan, recently installed these four Verson 250 ton eccentric presses.

Used as individual units, the machines are employed for blanking, drawing and forming operations on a variety of parts. In operation as a production process, the four units are utilized for the fabrication of station wagon panels. Primary production is on seat backs and cushions and floor panels for a major automotive manufacturer.

The four machines are identical. Each has a capacity of 250 tons with slide and bolster area measuring 48" x 96". Operating speed is 25 SPM.

If versatility of operation is one of your aims . . . and more profitable production essential, look into the Verson concept . . . "Anyone can build a press . . . Verson builds production processes."

182

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9307 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

If it moves...

Timken-Detroit® Brakes can stop it!

New lightweight... Fabricated steel brake shoes weigh many pounds less than cast shoes. Binding or freezing up is eliminated because double web construction permits limited area fit with one piece cam rollers. Wear areas of the webs are heat treated for long life.

Unit-mounted... All brake parts are mounted on the spider for compactness. Efficiency is higher and correct cam shaft alignment is assured with close coupled cam shaft and chamber bracket.*

"P" SERIES POWER BRAKES

designed for heavy-duty automotive service

Here is a brake that gives longer, trouble-free service for trucks, trailers, and all types of industrial and road equipment. These heavy-duty "P" Series Brakes are easy to maintain in service. Simplicity of design is the keynote—with brake, air chamber, and cam shaft all mounted as a unit.

The outstanding features of the Timken-Detroit "P" Series Brakes give increased economy and performance. Operating temperatures are lower and lining life longer because open-type spiders assure good internal ventilation and rapid cooling. Timken-Detroit "Econo-liners" are tapered to provide greatest thickness where greatest lining wear occurs.

A constant-life "S" type cam assures uniform application of brake shoes for maximum control and immediate response. Brake adjustments are quick with easily accessible slack-adjusters. Long wearing nylon bushings assure smooth operation with minimum maintenance.

"P" Series Power Brakes are available in a complete range of capacities and sizes to fit every operating requirement.

*"P" Series Brakes are also available with inboard chamber mounting for special applications.

Another Product of...

Rockwell Spring and Axle Co.

ROCKWELL SRA

BRAKE DIVISION
Ashtabula, Ohio

For every industrial, agricultural or automotive application where braking is required!

HOW THE SILICONES MAN HELPED...

TAKE THE RUB OUT OF RUBBER SEALING STRIPS

Weatherstrip rubber around doors, windows, trunk and hood, should seal, not squeal. Lubricants have been tried, only to be found lacking in many respects. Then the Silicones Man suggested a new kind of silicone lubricant. Now there's no need for squeak in any of the new cars.

Developed for the Ford Motor Company, the silicone lubricant for rubber gives just the right slip between rubber and metal, eliminating squeaky, torn and broken sealing strips. This new lubricant resists rain and water, is greaseless, and gives minimum interference with "touch-up" painting. Originally designed for assembly line application, this new lubricant is available nationwide at new car dealers for service use.

This is another example of how the UNION CARBIDE Silicones Man helped solve an "impossible" problem. A booklet, "Let the Silicones Man Help Solve Your Problems" describes many of the unique silicone products and their applications. Write today for your copy. Dept. CB-4704, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, New York. *(In Canada:* Bakelite Company, Division of Union Carbide Canada Limited, Toronto 7, Ontario)

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

UNION CARBIDE TRADE-MARK SILICONES

The term "Union Carbide" is a registered trade-mark of UCC.

XXVII

This is the twenty-seventh of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Cold-Finishing of Alloy Steels: The Effect of Cold-Drawing

The cold-drawing of alloy bars was discussed in the advertisement prior to this one, No. XXVI in the series. Here, we continue with a general explanation of the effect of cold-drawing.

During the cold-drawing process, certain changes take place in the steel structure, and in mechanical properties. There is a slight increase in tensile strength, compared with a substantial increase in yield point, and a decrease in ductility. These properties enable the production of small parts which require the greater strength necessary for certain automatic-machine forming operations, and a machine finish superior to hot-rolled material. Naturally, the beneficial effects of alloy steels are attained in the subsequent heat-treatment of parts.

The process of cold-drawing results in bars which are free from scale, accurate to shape, and within close tolerances. These conditions are ideal for automatic machining, as the elimination of scale is conducive to long tool life, and the accuracy of shape and close tolerances permit the bars to pass freely through the feed mechanism of the "automatic." Moreover, the cold-drawn finish and tolerances may be such that machining can be eliminated in some areas of the finished part. For example, sparkplug shells are produced from hexagon bars which require no machining on the hexagon sections.

Continuous roller hearths and car-bottom furnaces of both standard and controlled-atmosphere types, are used for special treatment of alloy bars before cold-drawing. Thermal stress-relieving can be used to reduce residual stresses in the steel caused by the cold-drawing process, wherein the mechanical properties will be altered depending upon the temperature used.

If you would like more specific details about the chemical composition or mechanical properties of cold-drawn alloy bars, and the results that can be expected, by all means consult our technical staff. Bethlehem metallurgists will gladly help you work out any problem, without cost or obligation on your part.

In the next advertisement, No. XXVIII in this series, the second category in cold-finishing will be discussed, i. e., the turning and grinding of alloy steel bars.

Remember that Bethlehem produces a wide and complete range of cold-drawn alloy steel bars in rounds, hexagons, squares, or flats, in standard, odd, decimal or metric sizes required, as well as special sections. Bethlehem also makes the full range of AISI standard alloy steels, and special-analysis steels and all carbon grades.

If you would like reprints of this series of advertisements from No. I to No. XXVII, please write to us, addressing your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa. The first 27 subjects in the series are now available in a handy 40-page booklet, and we shall be glad to send you a free copy.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

A Revolutionary
NEW CONCEPT
of FOUR CYCLE
RECIPROCATING ENGINES

The original 200+ H.P. engine is designed specifically for use in light planes, trucks, busses, tractors, stationary or marine applications.

NOW APPROVED BY C.A.A.

✓ **FORCES ARE CONTROLLED**
Centrifugal forces are eliminated. Reciprocal forces are offset near their source.

✓ **MANY MAJOR IMPROVEMENTS**
The Herrmann engine has many valuable demonstrable major improvements not possible with conventional engines.

✓ **USES HALF AS MANY PARTS**
Here is a phenomenal engine, powerful, responsive, with a never-before-possible economy. Original cost is reduced drastically because it has no crankshaft, no valve camshaft, no connecting rods, no rocker-arms, no push rods, no vibration damper, no counterweights.

For other details see Automotive Industries, Sept. 15, 1957, pp. 162-3. Operating Engines Available for Demonstration. Write to

KARL L. HERRMANN
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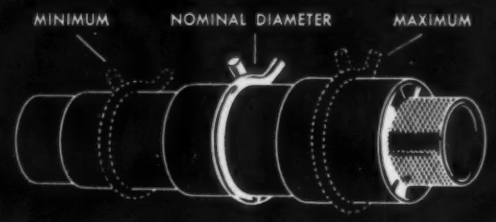

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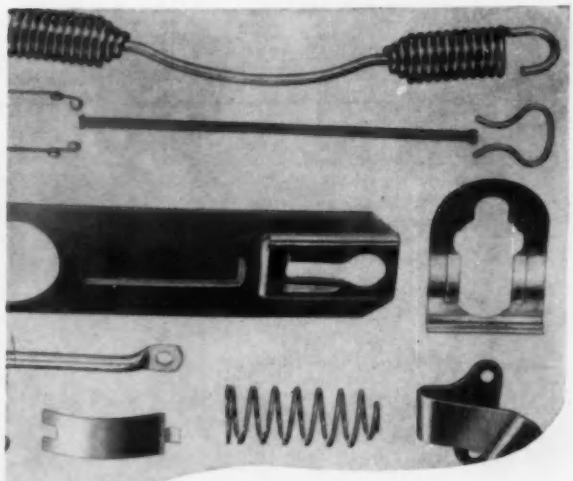

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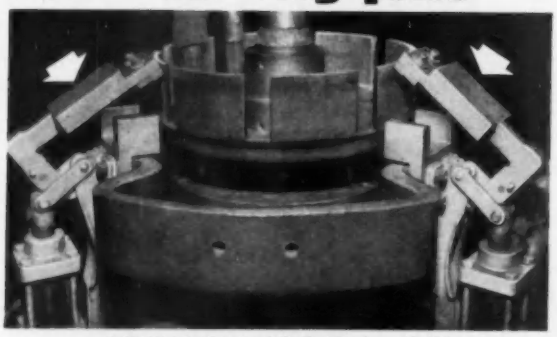

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MODEL 412 DRIER-RECEIVER with sight glass. PA-400 silica gel protects 100% against acids and moisture. Capacities: up to 3 tons.

PRESSURE-TYPE DISTRIBUTORS — uniform flow to all circuits. Any size and number of outlet openings; also side openings for by-pass connection if required.

OUTSTANDING among research and testing techniques employed by Controls Company of America on its automobile air conditioning controls is the use of this modern wind tunnel.

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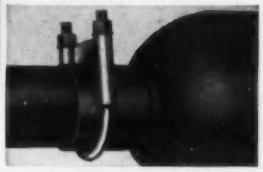
CLAMP . . . don't CRAMP MUFFLER CONNECTIONS

Get 360 Degree, 100% Leak-proof Tightness

This new, patented, precision-formed Clamp provides a positive 360° leak-proof seal of superior strength yet possessing sufficient flexibility to prevent "freezing" and possible joint breakage. Light weight; easy to assemble; improves exhaust system; gives long-lived service; re-usable.



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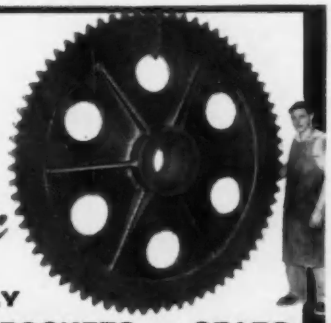
PRECISION FLAME MACHINING by Cogmatic cuts costs DRASTICALLY on LARGE SPROCKETS and GEARS



(Above) *3000 lb. fabricated 70 tooth 90.56" P.D. Sprocket.* (Left) *3 strand roller chain sprocket.*

- Flame machining from 1045 steel plate or rolled steel rings up to tolerances of .008"
- Almost any size, shape of tooth and spacing
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COGMATIC DIVISION, SEAMAN-ANDWALL CORP., Milwaukee 1, Wis.
Rush catalog describing Cogmatic Precision Flame Machining
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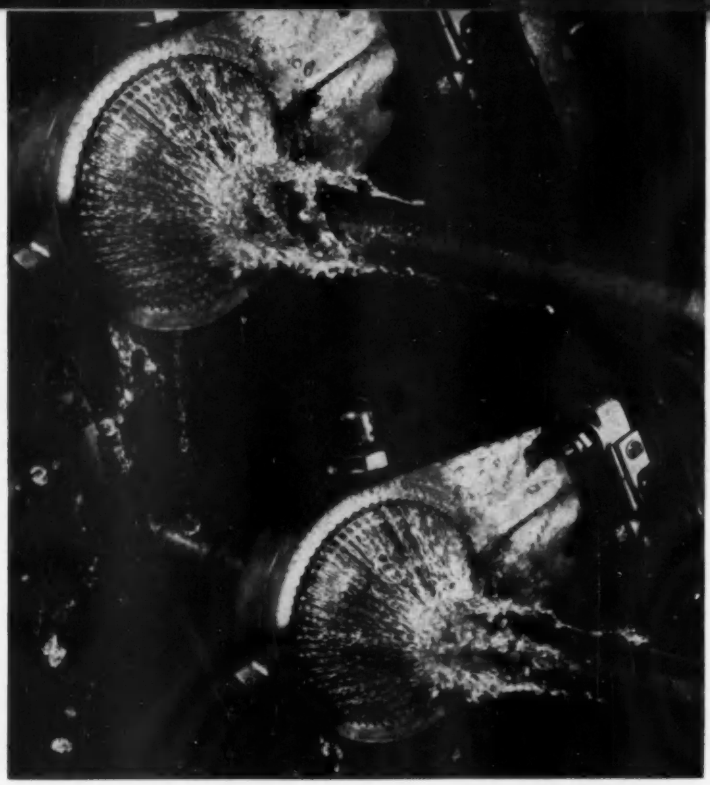
THIS IS A PICTURE OF $152,880



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Here is how Hightower-Morse & Company is successfully meeting the cost-price squeeze with Westinghouse Induction Heating. In the horizontal hardening of automotive axles, this progressive manufacturer found it imperative to invest in modern equipment to produce an improved product and hold the price to customers at a reasonable level. Here are the facts:

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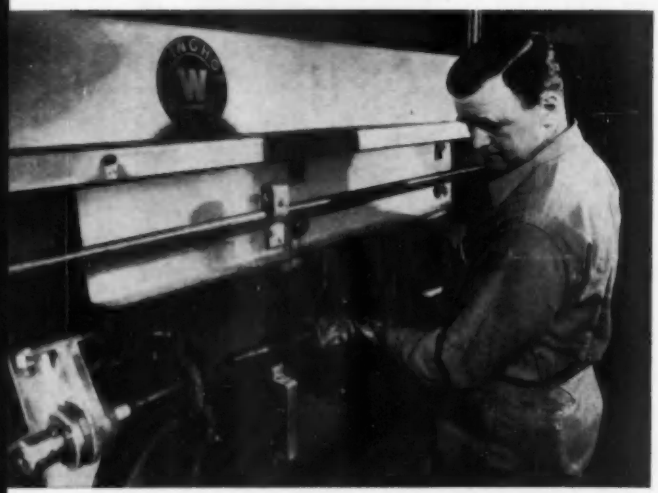
Drills last longer	1/3¢
Lathe tools last longer	1/5¢
Increases production because of less down time for changing cutting tools	1-9/10¢

Another saving—gas furnaces must run 24 hours a day at estimated $10 per-hour fuel cost, but Westinghouse Induction Heating uses current only when work is going through; electricity costs $3.50 per hour.

What's your problem—rejects, high costs, quality control? Your Westinghouse Induction Heating specialist can suggest applications in your plant for Westinghouse integrated production-line equipment.



Axles pass through coils of Westinghouse horizontal scanner two at a time at Hightower-Morse & Company. This one-man operation requires 60% less space than furnace heating; gives exact control of temperature and quench. J-35005

NEW—from Westinghouse Engineering and Development—LOW DISTORTION Induction Hardening Machine. It combines hardening, drawing and distortion reduction in one operation. Ask your Westinghouse specialist for complete information.

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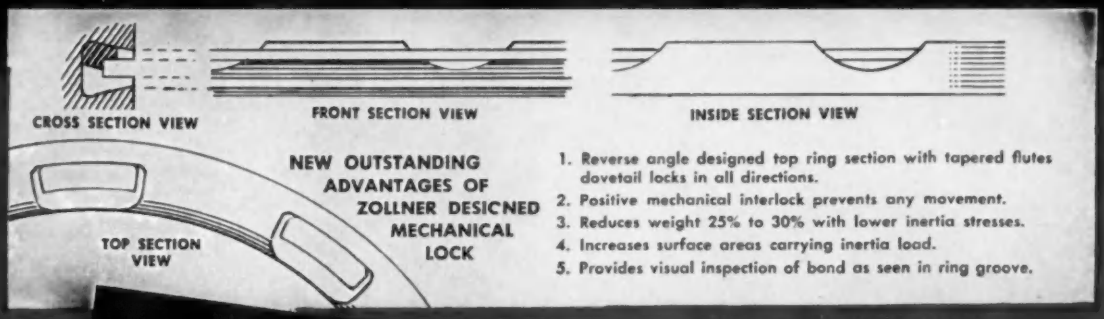
WITH "NI-RESIST" IRON TOP RING SECTION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INSIDE SECTION VIEW
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2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
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THE ORIGINAL EQUIPMENT PISTONS

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ND FACTS

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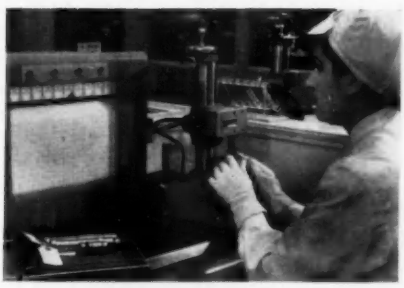
New Departure, foremost producer of high-performance ball bearings for automobiles and aircraft, takes great pride in its ability to meet the exacting specifications of the products for the Army, Navy and Air Force programs.



Comparator measures dimensions to one-millionth of an inch. One of many pieces of ultra-precision equipment in the New Departure bearing laboratories.

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1908–1958

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